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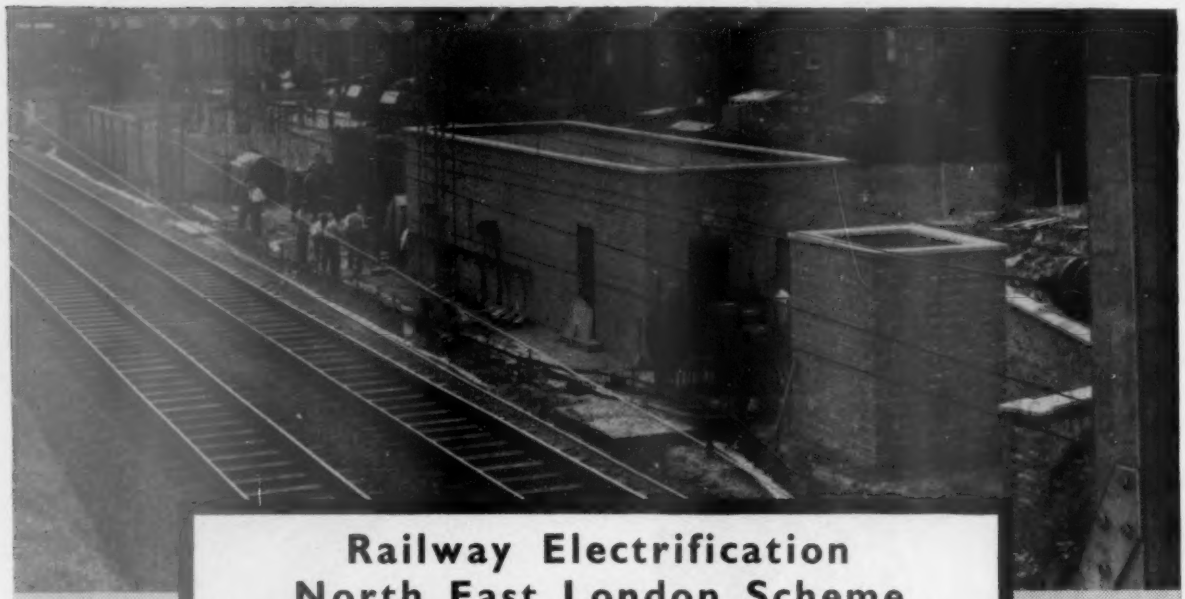
PONTYPOOL, MON.
Head Office:
47 Park Street, London, W.1

Photo by courtesy of British Railways (London Midland Region)

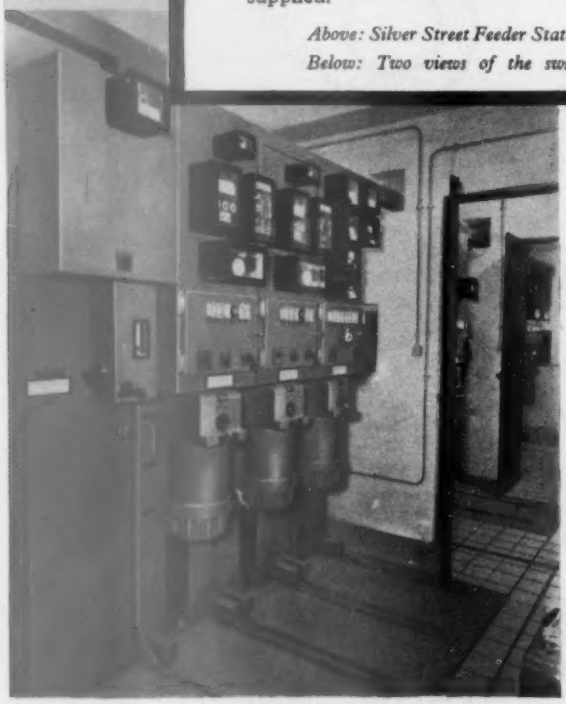
Investigation into track-spraying techniques has led to the development of two prototype sprayers. Completely modern in conception, and designed with the needs of today's diesel electric railways in mind, this equipment brings chemical weed control out of the steam age.

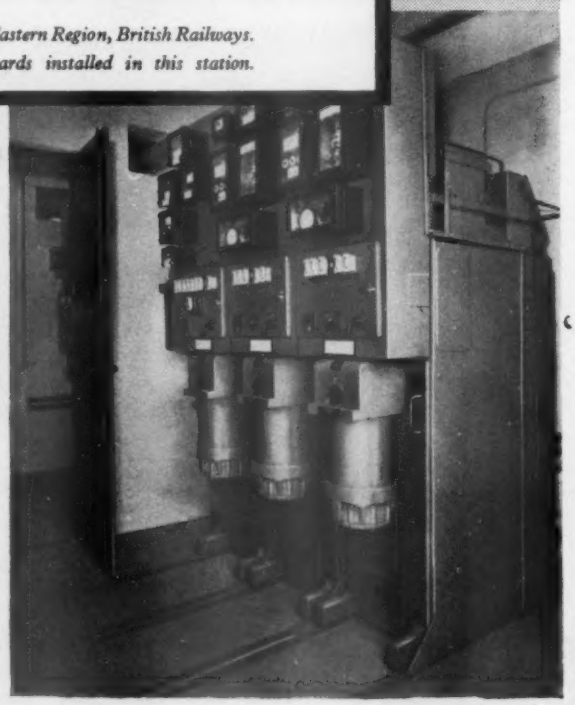


Railway Electrification
North East London Scheme
British Railways : Eastern Region

S.W.S. Switchgear has been installed in large quantities in the railway electrification schemes of the British Railways, Eastern Region. This gear, which has been specially developed for the purpose, comprises single phase, air-insulated metal-enclosed oil circuit breaker units for 6.25 kV, 150 MVA 600A and 1200A duties, and fuse-switches designed to line up with the oil circuit breaker units and incorporating 3-position oil switches.
Wall mounted, totally enclosed fuse-switch and distribution boards for substation heating and lighting and auxiliary services have also been supplied.

Above: Silver Street Feeder Station, Eastern Region, British Railways.
Below: Two views of the switchboards installed in this station.





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BLACKWOOD • MONMOUTHSHIRE • WORKS AT TREFOREST AND BLACKWOOD
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More than

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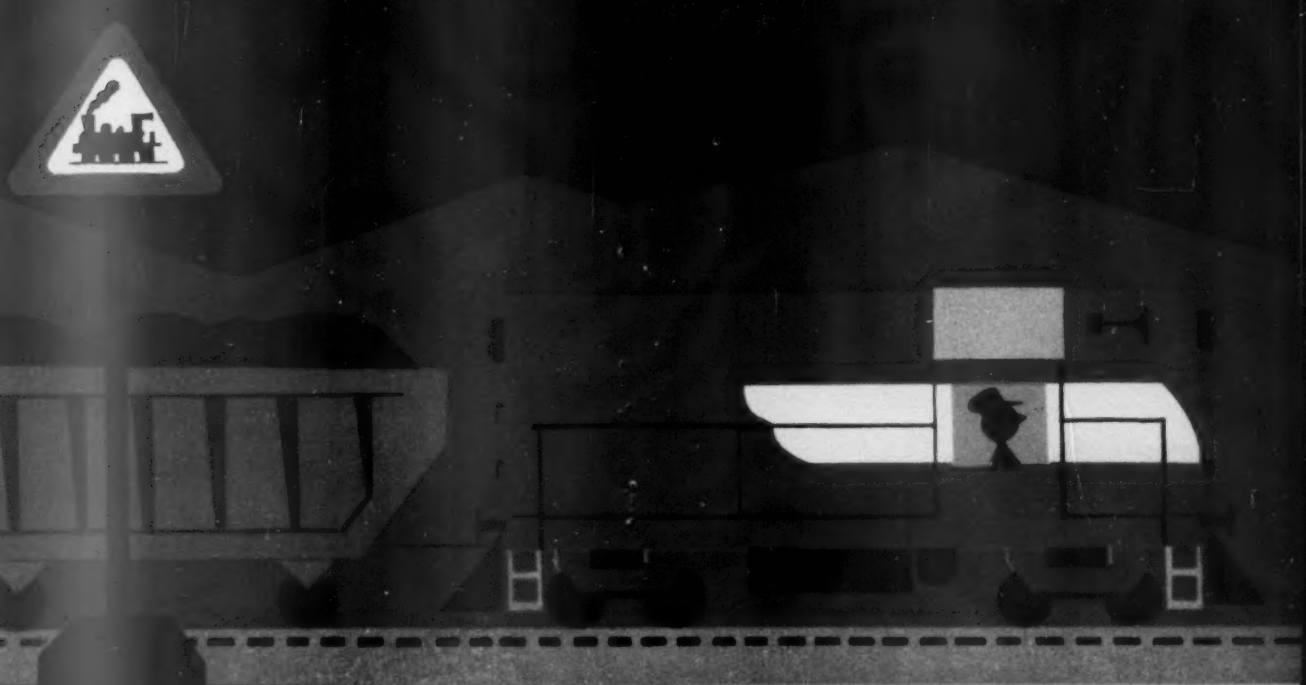
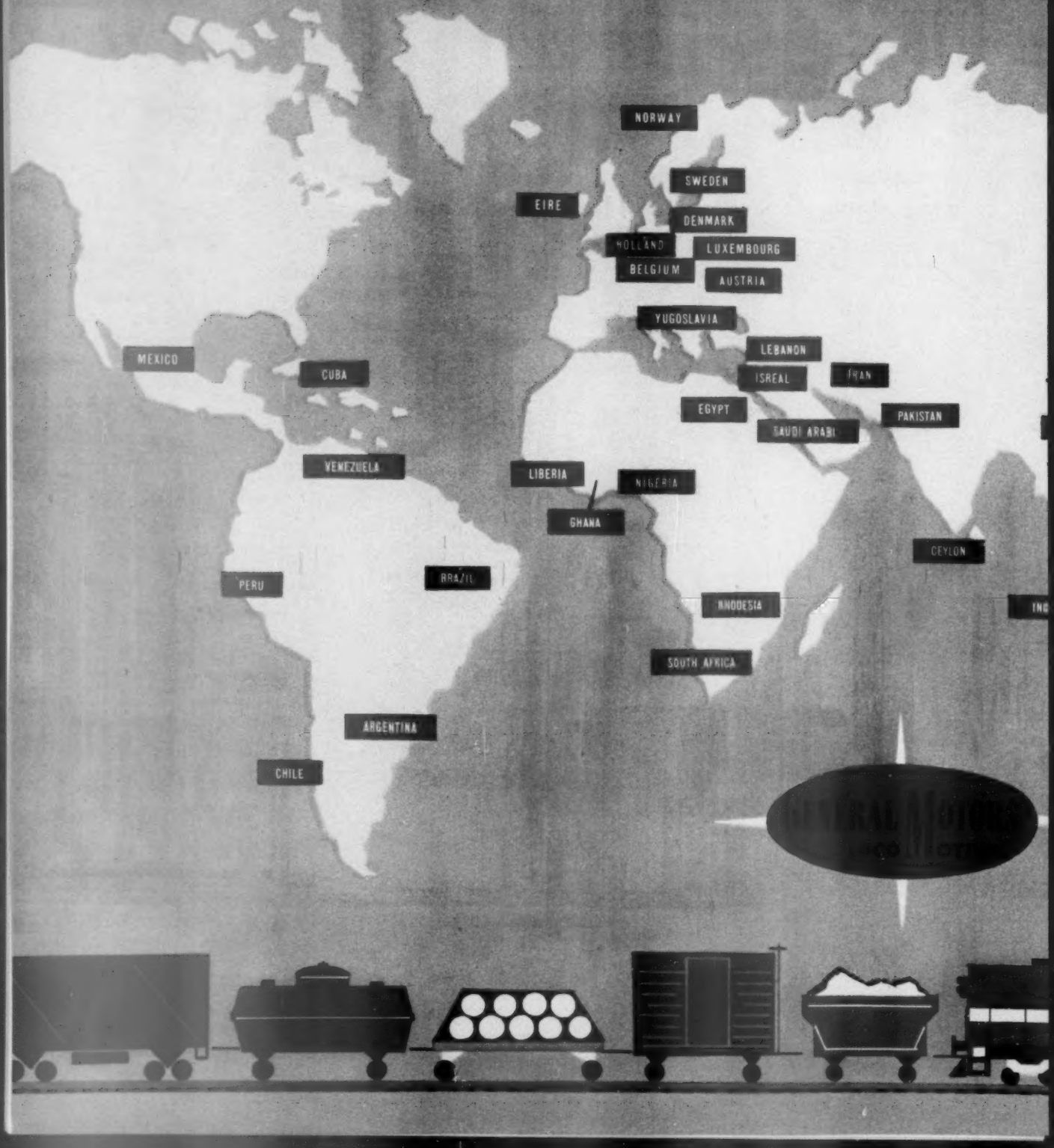
GENERAL MOTORS LOCOMOTIVES

now at work on railways of the world
-and the honour roll of customers keeps growing!

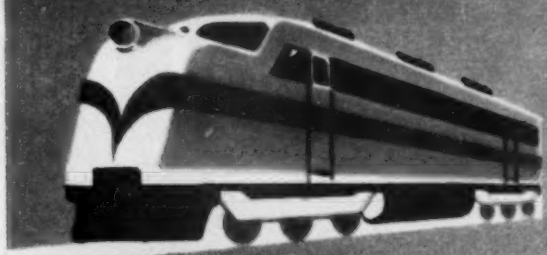


SYMBOLS OF TRANSPORTATION PROGR

General Motors Locomotives Operate on 163 Railroads in the United States and Canada, plus 33 other Countries

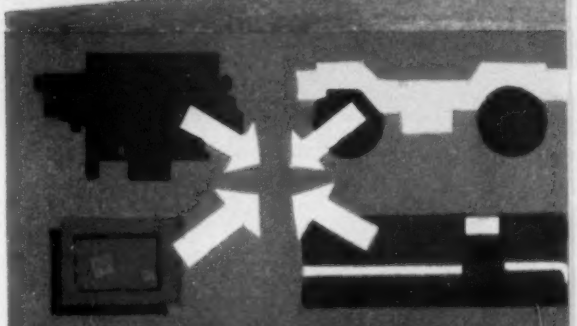


SS ON 6 CONTINENTS



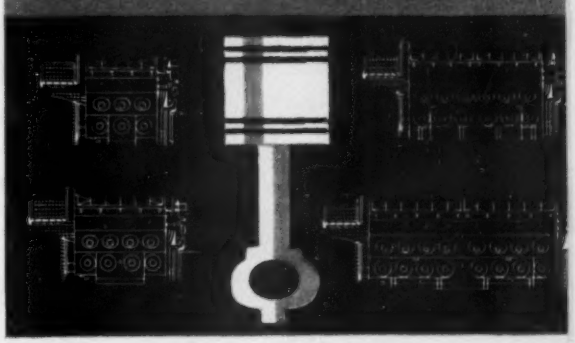
First to Successfully Apply the Diesel Engine to High-Speed Passenger Service

History was made early in 1934 when the world's first lightweight, high-speed Diesel-powered streamlined passenger train moved under its own power. The principles of its 600 h.p. two-cycle engine, weighing under 20 pounds per horsepower, were then applied to the development of the GM 567 series engine. Built in a V arrangement of 6, 8, 12 and 16 cylinders, this engine has undergone constant improvement since 1938, and has established unparalleled records for dependable, low-cost service.



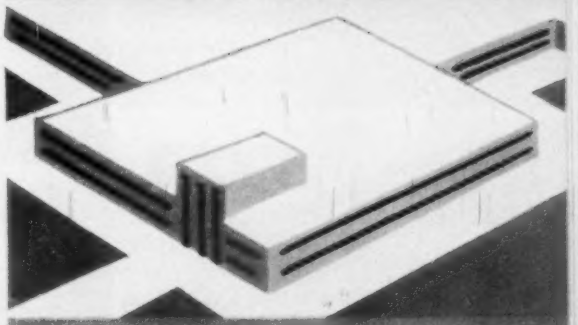
Integrated Design of Standardised Motive Power Units

Development of the General Motors Diesel locomotive to its present efficiency stems from a basic concept of coordinating all major components—prime mover, transmission, controls and car body—into standardised units of balanced design. Pursuit of this principle has resulted in the evolution of Diesel locomotives that not only meet all railway requirements, but tremendously improve operating efficiency and reduce cost for railways around the world.



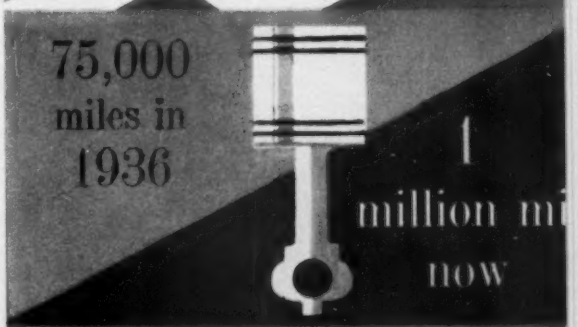
Pioneers in Volume Manufacture by Mass-Production Methods

The unit principle of a few basic designs accommodating all railway requirements enabled General Motors to apply all its skills of mass production to the highly complex manufacture of Diesel locomotives, comprising some 70,000 individual pieces. Instead of custom-building each job, General Motors engineers pioneered the development of subassembly techniques—and, equally important, achieved a high degree of parts interchangeability which means lower costs.



***One* Manufacturer—*One* Source of Service Responsibility**

Unique advantage of General Motors locomotives is that the design and manufacture of all major components are centred in *one* organisation. This concentration of responsibility for all phases of locomotive performance results in a balance of design—uniformity of high-quality manufacture—and parts and service protection that is unrivalled by other builders.

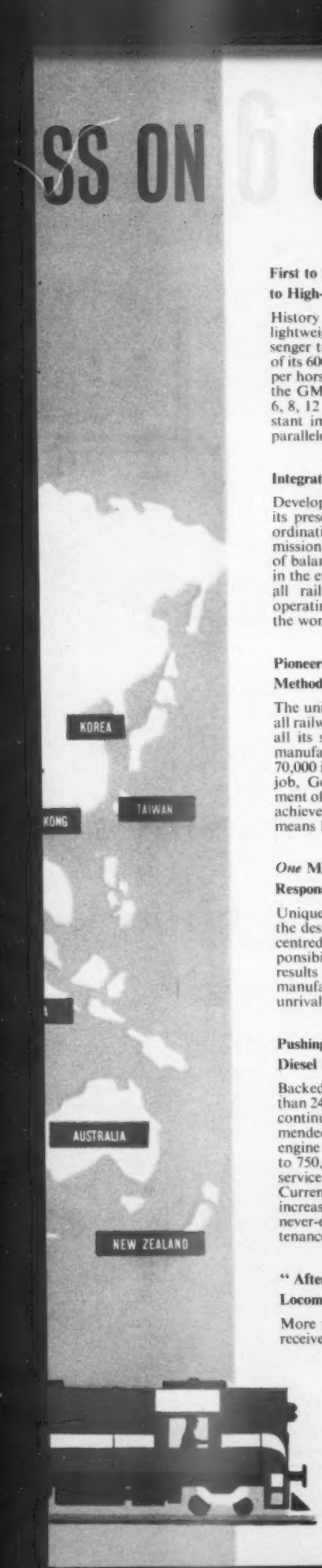


Pushing Past Old Frontiers to New Horizons in Diesel Engineering

Backed by the experience gained in the building of more than 24,000 Diesel locomotives, General Motors engineers continually push to new horizons. In 1936 the recommended replacement period for a piston in a 567 Series engine was 75,000 miles. Today that has been lengthened to 750,000 miles and reports of pistons that have been in service for 1,000,000 miles and more are not uncommon. Current developments include intensive work to achieve increased power with lower fuel consumption, plus a never-ending search for improvements that reduce maintenance requirements.

" After the Sale " Services Help Keep General Motors Locomotives on the GO

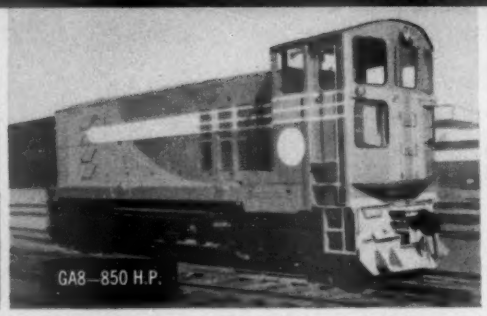
More than 100,000 railway men from 40 countries have received instruction from the Diesel Locomotive Training Centre, La Grange, Illinois, U.S.A. Thousands more have been given on-the-job training in locomotive operation and maintenance. A world-wide staff of specially trained men work closely with railways to help them obtain maximum economies in Diesel operation.



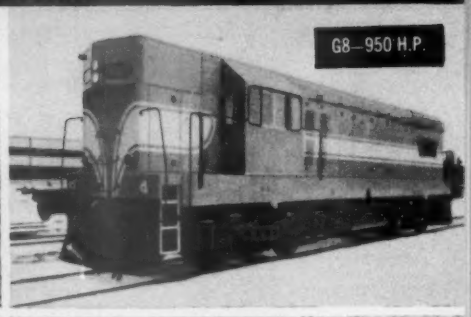
GENERAL MOTORS LOCOMOTIVES

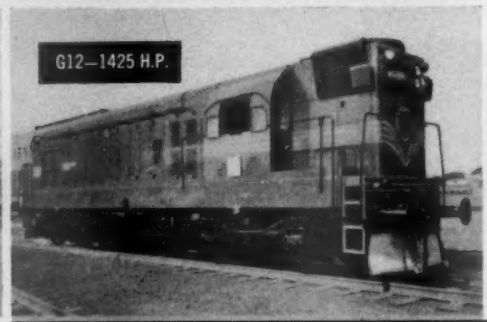
—the most productive tools for every class of railway service

DIESEL-ELECTRIC LOCOMOTIVES

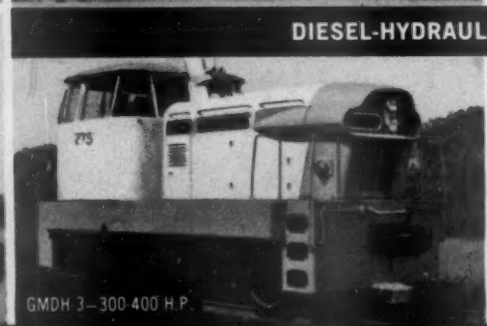


DIESEL-ELECTRIC LOCOMOTIVES





DIESEL-HYDRAULIC LOCOMOTIVES



AUSTRALIA—The Clyde Engineering Co. Pty., Ltd., Sydney, N. S. W. BELGIUM—LaBrugeoise et Nivelles, St. Michel-lez-Bruges • GERMANY—Henschel-Werke, GmbH, Kassel • SOUTH AFRICA—Union Carriage & Wagon Co. (Pty.) Ltd., Nigel, Transvaal SPAIN—Material y Construcciones, S. A., Barcelona • SWEDEN—Nydqvist & Holm Aktiebolag, Trollhattan

Electro-Motive Division of General Motors, La Grange, Illinois, U. S. A.
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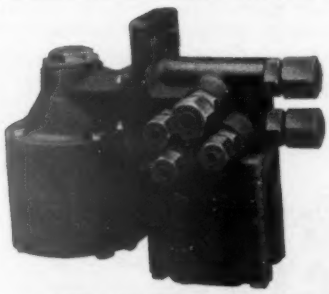
AIR BRAKE EQUIPMENT for Locomotives

OERLIKON PATENT DESIGN

TYPE FV.3 An Automatic Driver's Air Brake Control Valve suitable for medium length goods and passenger trains or railcars, etc. This Valve is simple to operate and of light weight construction. It enables the full benefit to be obtained from modern step-by-step application and release of air brakes. Leaflet A.1.

TYPE FV.4 A standard Driver's Automatic Air Brake Control Valve with automatically controlled high pressure brake releasing impulse. This Valve enables the maximum speed of brake release to be obtained, and in addition enables the full utilisation of all the advantages associated with modern air brakes. The Valve is reliable in service and simple to operate and maintain and is especially suitable for long express passenger and goods trains. Leaflet A.4.

TYPE FD.1 This is a simple Brake Control Valve suitable for direct braking or shunting brake requirements. It is very simple to use and accurate in operation. The type FD.1 Valve can also be adapted for the control of the Diesel engines and can also be made suitable for cam operation. Leaflet A.13.



TYPE LST.1 A locomotive Triple Valve of modern and simple design. The LST.1 Operating Valve embodies a control for freight or passenger train operation, together with a high efficiency Brake relay, also an Anti-skid Brake device may be provided when required. This Valve is capable of controlling the air supply to several Brake Cylinders when required. Leaflet A.2.

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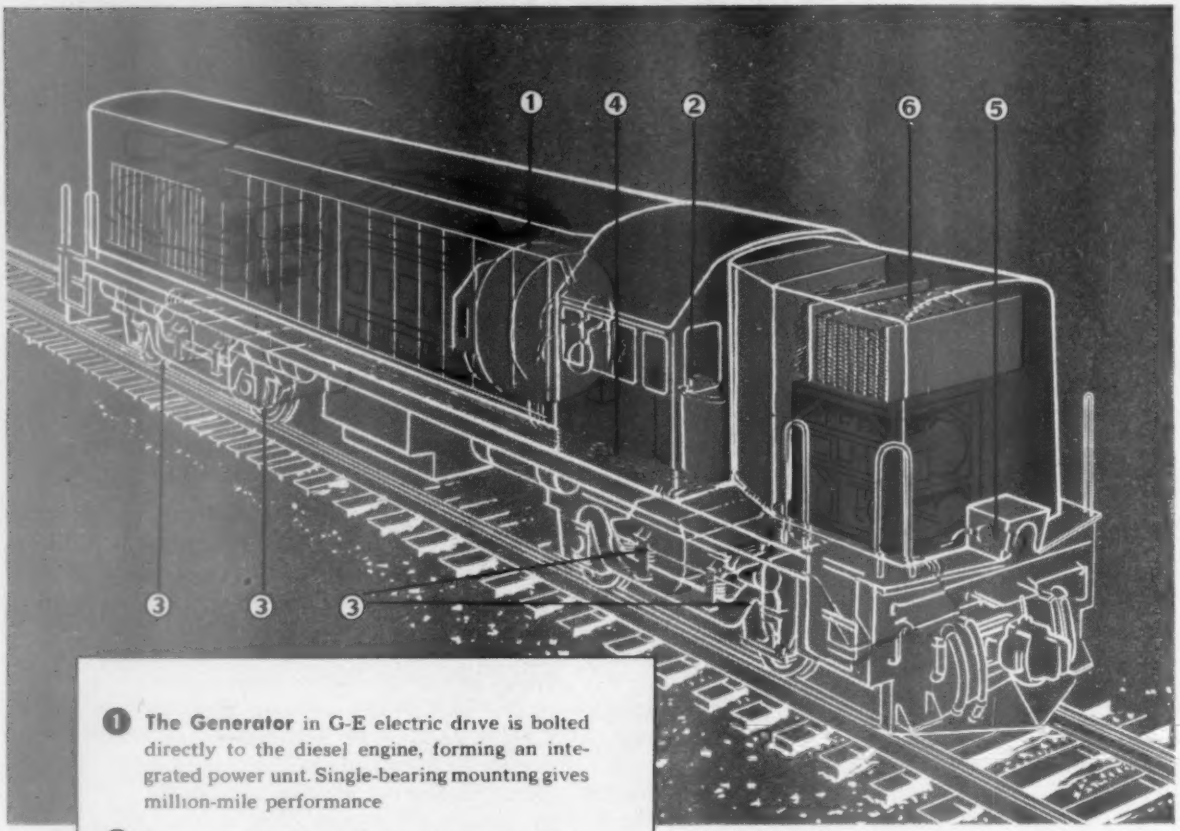

1 **The Generator** in G-E electric drive is bolted directly to the diesel engine, forming an integrated power unit. Single-bearing mounting gives million-mile performance

2 **Power Controls** are dependable and easy to operate. There are no gears to shift either forward or reverse; delivers maximum horsepower at all speeds.

3 **Traction Motors** proved in millions of miles of rugged railway service apply power direct to every wheel through simple spur gearing

4 **Flexible Cables** transmit dependable power with ultimate efficiency, eliminate the many costly maintenance problems inherent in any other power-transmitting systems.

5 **Multiple Unit Control** is obtained simply by plugging in a jumper, and two or more units can be operated as easily and responsively as one.

6 **Dynamic Braking** for greater safety, faster schedules and reduced brake equipment wear, uses the powerful traction motors as generators, dissipating heat through resistors.

135-E 30

G-E electric drive proved in use by more than 20,000 locomotives

Over half a century of performance records testify that G-E Electric Drive is the most dependable, efficient and economical locomotive transmission.

The simplicity of electric drive is the key to its success. A source of electric power, traction motors and responsive controls – linked together with flexible cables to transmit smooth-flowing electric power – that's electric drive!

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Why Sprayed LIMPET Asbestos? Because it is the only insulation to combine: **INCOMBUSTIBILITY · HIGH THERMAL EFFICIENCY · EFFECTIVE SOUND ABSORPTION · ELIMINATION OF DRUMMING · LIGHTNESS IN WEIGHT CORROSION INHIBITION.**

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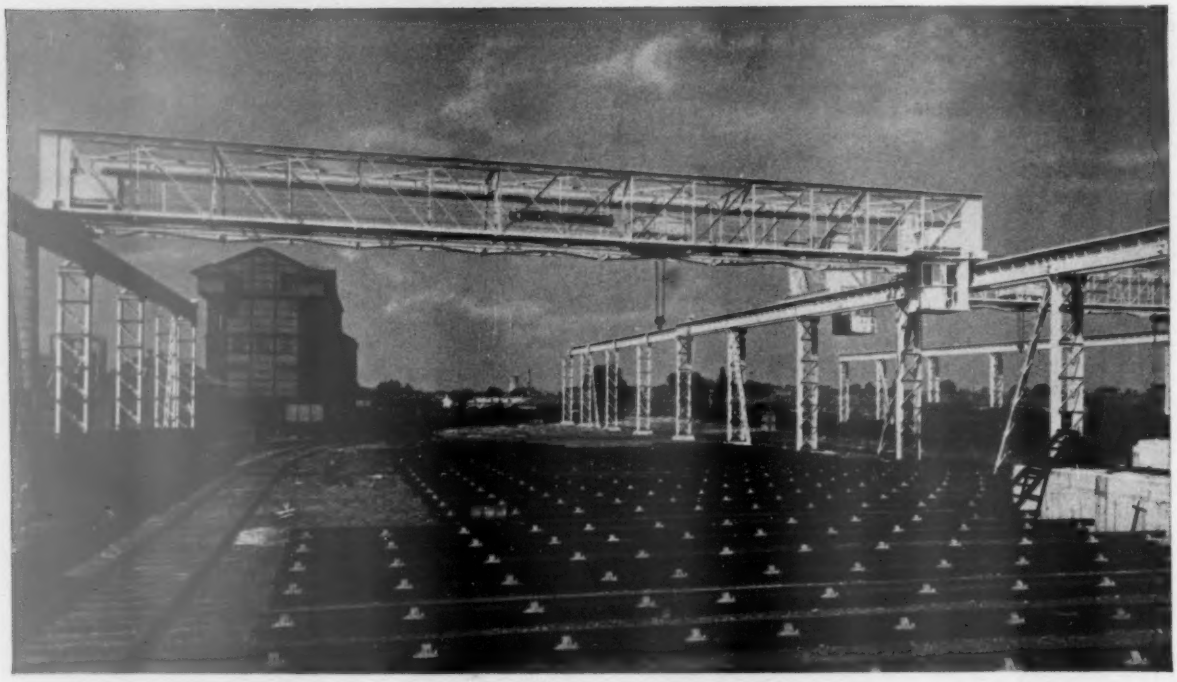

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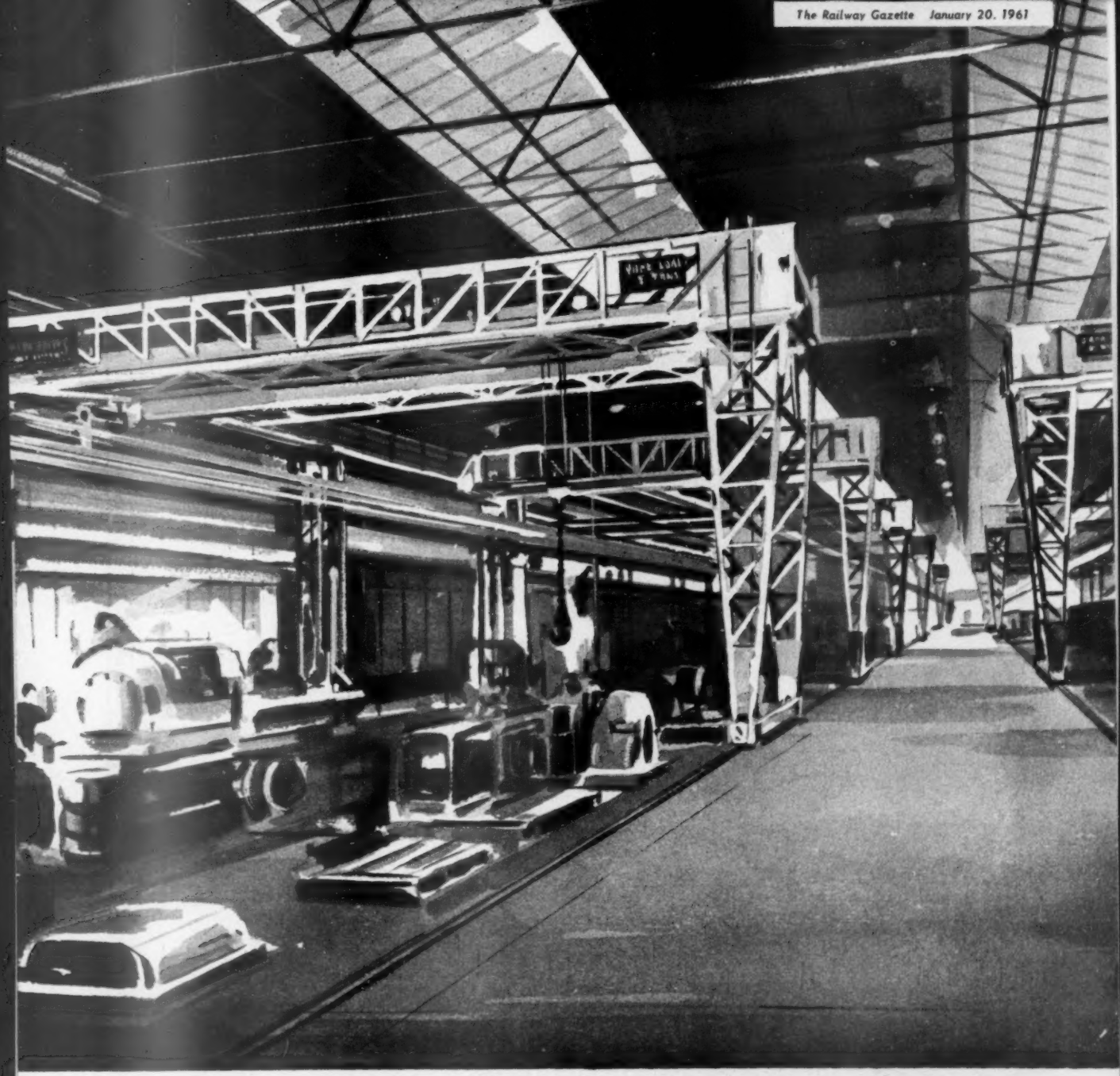

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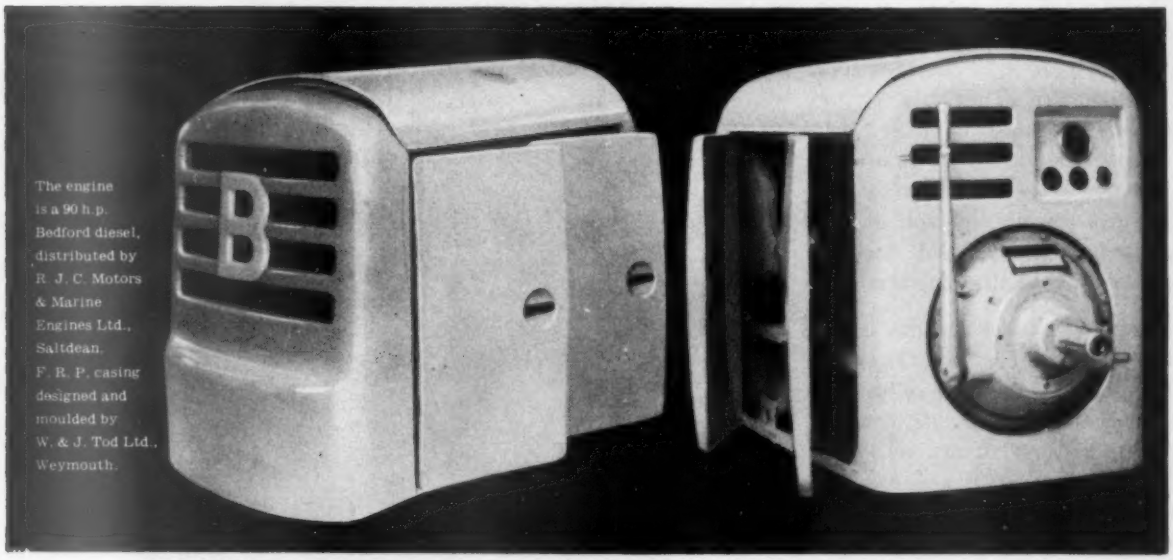
Extract from a report on this engine casing in Fibreglass Reinforced Plastics.



The engine is a 90 h.p. Bedford diesel, distributed by R. J. C. Motors & Marine Engines Ltd., Saltdean. F. R. P. casing designed and moulded by W. & J. Tod Ltd., Weymouth.

Engine casings were needed. The alternatives: moulding in F.R.P. or shaping in metal. The choice: F.R.P. This is why.

F.R.P. is light yet strong; it can, as in this case, be self-coloured, needing no painting or maintenance; it is unaffected by exposure to the weather and does not drum; it can be moulded easily and styled attractively. Finally, F.R.P. is highly resistant to most forms of corrosion—including the sulphur fumes given off by diesel fuel.

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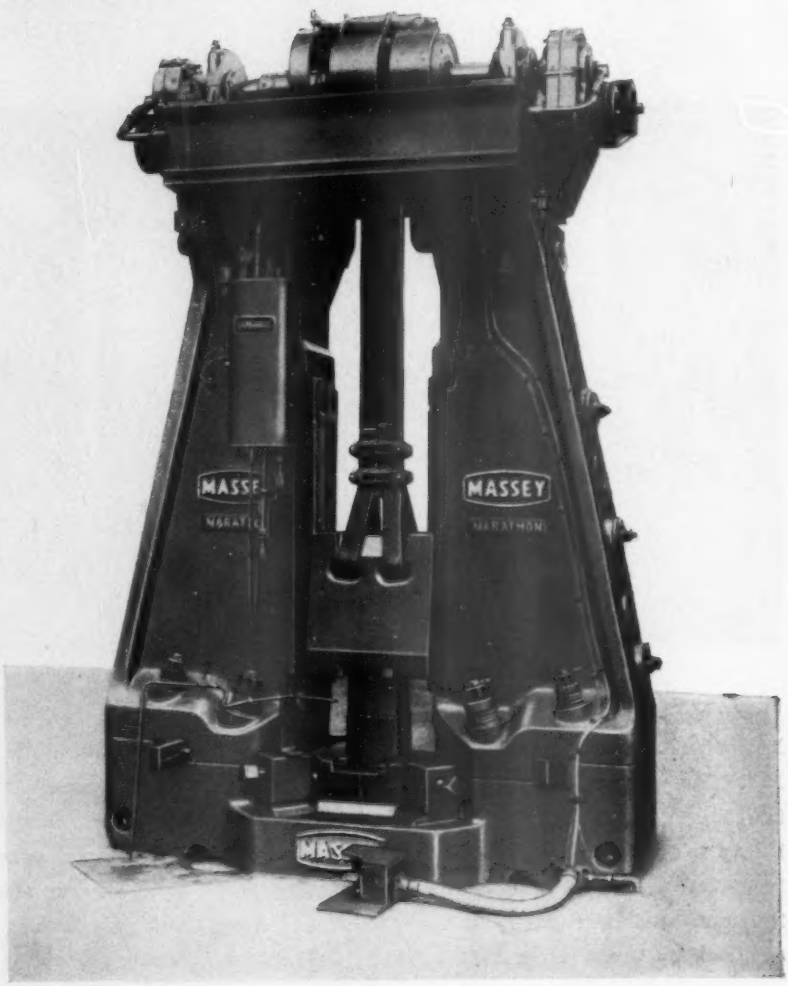

20 cwt. Marathon Drop Hammer in our own forge.

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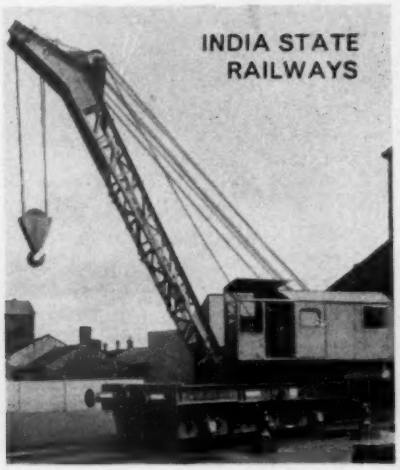
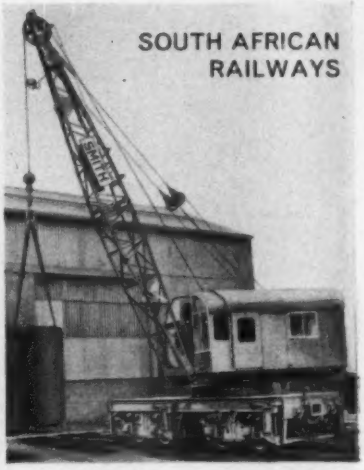
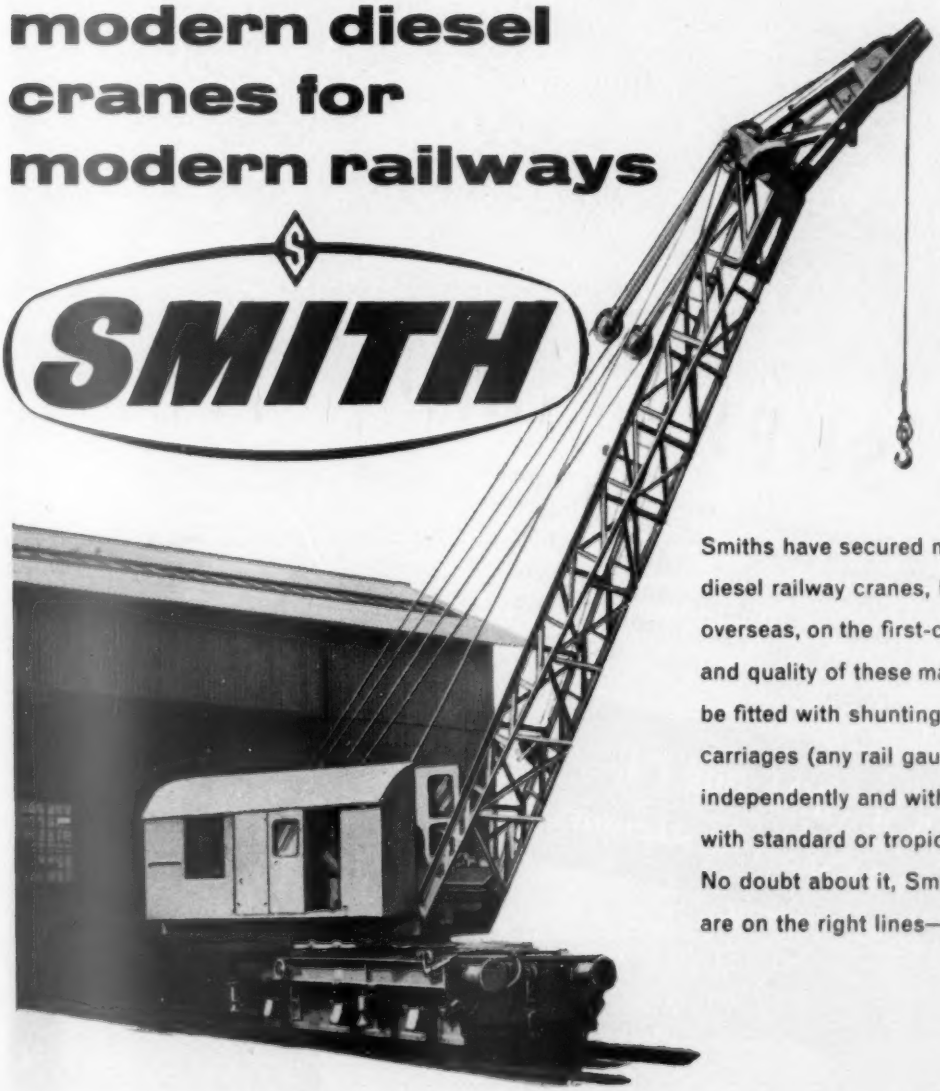




modern diesel cranes for modern railways

SMITH



Smiths have secured many contracts for diesel railway cranes, both in Britain and overseas, on the first-class design, efficiency and quality of these machines. They can be fitted with shunting or non-shunting carriages (any rail gauge), to travel independently and with rolling stock; and with standard or tropical cabs, as specified. No doubt about it, Smith railway cranes are on the right lines—all over the world!

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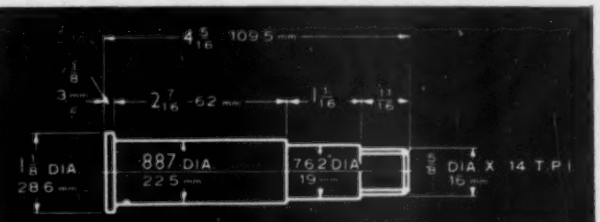
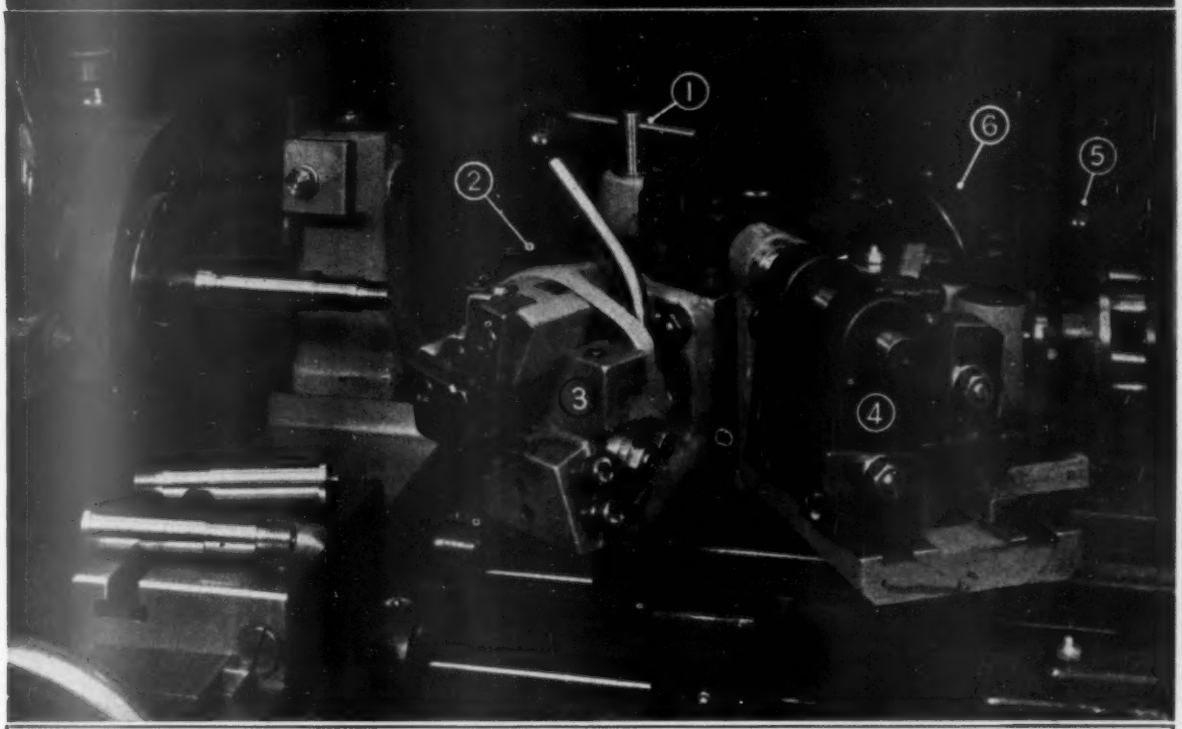
Ward SPECIAL TOOLING LAYOUT No. 11





STEEL SPINDLE

1 7/16" dia. Steel Bar E.N.8. 40 ton Tensile Steel Tungsten Carbide Cutting Tools.

2DS CAPSTAN LATHE

Code Word : **Twods**

Fitted with 1¼" Air Bar Chuck and Air Bar Feed.

Floor to Floor Time : 1 min. 45 secs.

DESCRIPTION OF OPERATION	Tool Position		Spindle Speed R.P.M.	Max. Cutting Speed		Feed	
	Hex. Turret	Cross-slide		Feet per min.	Metres per min.	Cuts per inch	m/m. per rev.
1. Feed bar to stop & close chuck	1	—	—	—	—	—	—
2. Centre drill	1	—	1110	—	—	Hand	Hand
3. Start turn	2	—	1110	343	104	Hand	Hand
4 Tangential roller turn ·887" dia.	3	—	1110	343	104	130	·195
5. Multiple roller turn 1⅛", ·762" & ·579" dias.	4	—	1110	343	104	130	·195
6. Thread roll ⅝"×14 t.p.i.	5	—	1110	181	55	—	—
7. Roller end and chamfer	6	—	1110	181	55	Hand	Hand
8. Tangential part off	—	Rear	1110	327	100	Hand	Hand

'PRELECTOR' Combination Turret Lathes with Preselective speed-changing.

TURRET LATHES with capacities up to 35 in. swing over bed

1½ in. to 2½ in. 'D-S' DOUBLE-SLIDE Capstan Lathes for heavier accurate work.

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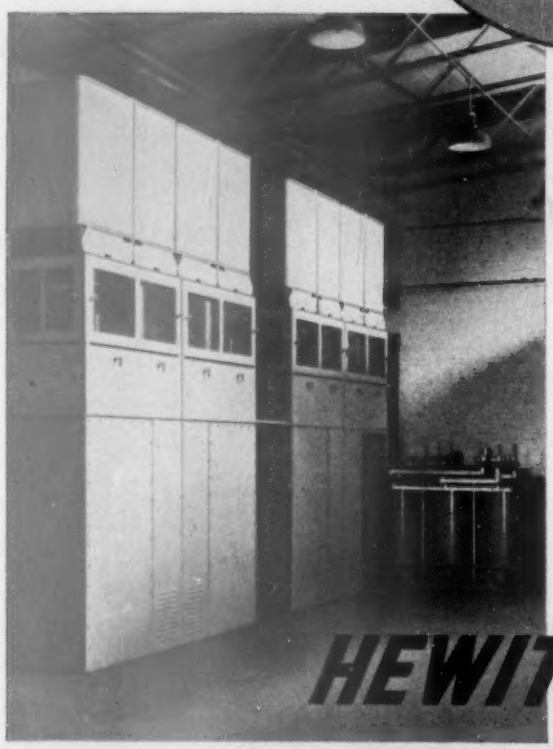

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The Hackbridge and Hewittic Electric Company is responsible for the supply of 9,000 kW of rectifier and enclosed air-blast-cooled transformer equipments together with associated A.C. and D.C. control gear at Charing Cross substation feeding the District, Bakerloo and Northern lines. This substation is designed for an ultimate capacity of 12,000 kW.

The photograph, left, shows two 1,500 kW equipments. One of the two main transformers in the farther set is withdrawn to show its location.

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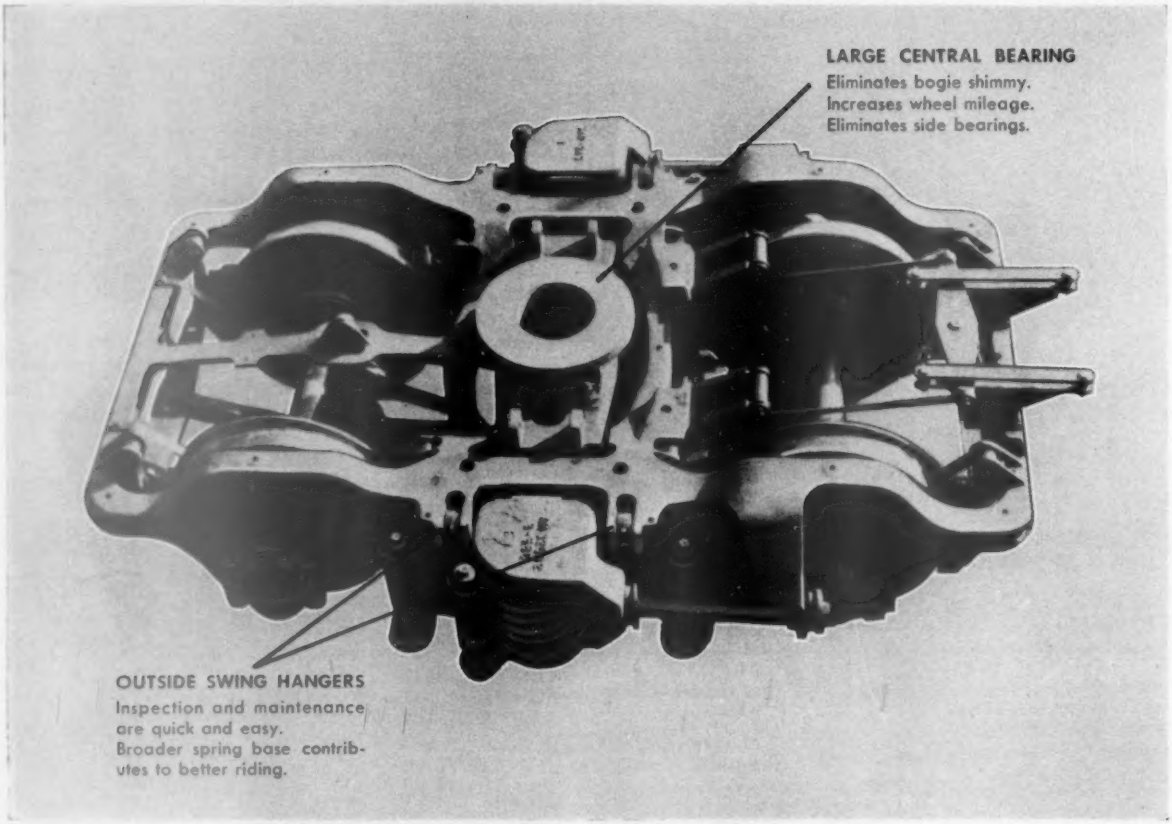

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Transformer failures

IN VIEW of the public concern over the Glasgow electrification failures, Brigadier Langley has created a precedent by issuing an interim report on his inquiry. This is summarised on a later page. In his report he has incorporated a parallel interim report by Mr. F. J. Lane, a partner of Messrs. Preece, Cardew & Rider, who was called in as a consulting engineer by the British Transport Commission. Both reports find that, whereas the earlier investigations took the line that the primary cause of the trouble lay in the oil-cooling system, later investigations pin-pointed the trouble on the secondary windings of the transformers. In fact, as originally designed, the transformers were not strong enough to stand up to the job. Until Brigadier Langley and Mr. Lane issue their final reports, judgment must be reserved as to how far these failures might have been averted. A new design has been prepared and will be tested, but several months must elapse before the Glasgow suburban electric service can be restored. Mr. Lane states definitely that there was no evidence that the Glasgow failures were attributed to the dual high voltage a.c. electrification system. Meanwhile, Brigadier Langley and Mr. Lane have extended their inquiries to the Eastern Region failures. Here they admit that the cause has not yet been established, and while several alternative and complementary theories are being tested, it cannot yet be predicted when the faults will be rectified. It is clear that a thorough and nation-wide investigation is in progress, which in time will bring full results. Once this is achieved, one can endorse the concluding paragraph of Brigadier Langley's report, in which he says, first that the British Transport Commission is pioneering the dual high voltage electrification system, as applied to multiple-unit trains running on an intensive suburban service; and second, that once these troubles have been cured, British-built electric traction equipment will be as reliable, efficient, and safe as any in operation in the world.

Glasgow steam services restored

THE FACT that British Railways Scottish Region took off an electric service and put back a steam service within 24 hr., and without previous notice, says much for the promptitude, skill, and devotion to duty of all concerned. The decision to withdraw the stock was taken so that the manufacturers could make modifications, following certain incidents which are the subject of an official inquiry summarised elsewhere in this issue. To achieve the switch-over, all the electric trains had to be removed to emergency storage sidings. A new steam timetable, with locomotive, carriage, and staff diagrams, had to be improvised and published. Steam locomotives and carriages had to be brought out of retirement, made ready, and moved to their starting points, and locomotive depots had to be reopened and re-stocked. A tribute to all these untiring efforts was paid by Mr. James Ness, General Manager of the Scottish Region, who, in a message published in the current issue of *British Railways Magazine*, thanked all staff employed on the Glasgow electric service for trying to keep it going under difficult circumstances, and called for unity to give the best possible alternative service.

Delay to the Queen's train

IN CONNECTION with the breakdown of the diesel locomotive which caused the Queen to arrive nearly an hour late at Sandringham on January 11, the Hawker Siddeley Group has stated on behalf of the Brush Electrical Engineering Co. Ltd. and Mirrlees, Bickerton & Day Limited (the member companies concerned) that a full investigation has revealed a fault located in the lubricating oil pump, a proprietary article. The statement continued that the locomotives concerned have a good reputation for reliability and the failure was the first of its kind and considered to be an isolated case. The locomotive had only run approximately 10,000 miles since it was supplied, while many of the same fleet had mileages approaching 200,000. The remainder of the fleet of 182 similar locomotives now in service on the Eastern Region of British Railways would not

be affected by the failure. Meanwhile, the Queen is reported to have expressed her regret for the trouble that British Railways is encountering with its modernisation programme.

Tough Assignment

SPEAKING as President of the Institute of Transport at the annual dinner of the Sheffield Section on January 16, Mr. K. W. C. Grand, Member of the British Transport Commission, stated that, while appreciating the Government's recognition of the railways as "a great national enterprise and a vital basic industry," all railwaymen also must appreciate the challenge made to their professional skill and moral courage. The proposals would involve a "truly formidable administrative exercise" in their implementation. It was to be hoped they would result in a relatively long period of stability and ordered development and an intake of young people of the right calibre. The first President of the Institute, Sir Eric Geddes, had believed that this country, the first to develop modern transport, had been the last to recognise the intimacy of the relation between the transport agencies and the public welfare. Mr. Grand concluded with a reference to railway developments in the Sheffield area: there was to be a major marshalling yard at Tinsley, a diesel locomotive depot within the yard area, and a freight concentration depot at Grimesthorpe. Large savings of staff would result—over 900 men—nine existing yards would be closed, and 279 steam locomotives would be replaced by 116 main-line diesels. A further scheme under development would virtually eliminate steam traction in the Sheffield area.

Selling British Railways

"THE JOB of every railwayman associated with rate-making and quoting is to get the best possible price consistent with the satisfaction of the customer and the establishment of the business on a firm footing." This quotation from the current issue of British Railways North Eastern Regional Sales Bulletin issued regularly by the Traffic Headquarters (Commercial) at York sums up its general aim which, in informal style, is to describe not only the general technique of selling, but also give details and background on the various services and facilities available to the public. Of evergreen interest but of particular present importance is the technique of salesmanship. Changing conditions have resulted in a gradual diminution of the near-monopoly of fast transport once held by the railways and in an equally real and inversely proportional importance of the individual railwayman, particularly the railwayman in contact with the public. "Internal Public Relations" must foster the proper sense of this individual importance in relation to the whole organisation, for without this sense an attitude may emerge which will produce the bad service which drives customers away.

Further exports essential

UNLESS effective steps are taken to achieve increases in exports, Britain will decline to a third-rate power within the lifetime of everyone under 60. This was the warning given last week by Mr. C. O. Stanley, Chairman of the "Export Action Now" committee of the Institute of Directors. He was addressing a meeting in London to support the drive initiated last October by Lord Chandos, President of the Institute. The campaign was welcomed by Mr. Reginald Maudling, President of the Board of Trade. Since the meeting between the Prime Minister and industrialists last July, he stated, there was much greater recognition of the need to export and a growing determination by businessmen to overcome difficulties. No informed person can doubt that leading British manufacturers, and not least those of railway motive power and other equipment, are making every effort. Much is being done by the Board of Trade in co-operation with other Government departments, notably in the field of commercial intelligence. But one may doubt whether the Government as a whole is yet seized of the necessity to extend our export trade. It could well co-ordinate and increase its efforts to help industry.

Action by Export Council for Europe

THE GOVERNMENT and industry in the meantime are co-operating to increase exports to Europe. Missions of businessmen and industrialists drawn from the 30 members of the newly-formed Export Council for Europe are to visit the Continent. There they will collaborate with the commercial representatives of the British Government, British trading interests, existing importers of British goods, and other bodies. This was agreed last week by the Council, under the chairmanship of Sir William McFadzean. Nine teams of three men will leave in February to visit Britain's six partners in the European Free Trade Association: Austria, Denmark, Norway, Portugal, Sweden, and Switzerland; and also France, Italy, and Spain, and, in May and June, ten other countries. Discussions will be on the basis of a questionnaire on market needs; foreign competition; price, quality, and design; study of successful British export efforts; and investigation of complaints. The advisability of inviting buying missions to the U.K. will be explored. The teams' findings will be used to guide the Council.

Timetable complications

GREAT BRITAIN is probably the only country in the world in which vast numbers of alterations are made in train timings between one issue of the timetables and the next. Owners of the Regional timetable books can obtain pamphlets listing the alterations, but these eventually grow to such dimensions that the discovery of individual alterations becomes an extremely complicated business; the current North Eastern Region alterations pamphlet, for example, lists no fewer than 88 changes in train times in Table 2 alone. The corresponding London Midland Region pamphlet had grown to 75 pages by January, with four months of the timetable still to run; it contains about 1,200 individual entries and 20 tables reprinted in their entirety. Many of the timetable sheets posted at stations become almost useless to those consulting them, for they have not even the alteration pamphlets ready to hand for confirming their train times. While there must be every sympathy with the desire to bring into operation at the earliest moment improvements made possible by the introduction of new motive power and trains, it is questionable whether all the other multiplicity of alteration, sometimes of only a minute or so in a train time, could not wait until the next timetable issue.

British Transport Commission traffic receipts

DESPITE great efforts to capture traffic British Railways traffic receipts during the 52 weeks ended January 1, 1961, were only 4·2 per cent above the total for the roughly corresponding period to December 27, 1959. Passenger traffic increased by 7·8 per cent. Goods receipts were 2·5 per cent up. As was to be expected, in view of increased production of iron and steel, the biggest rise, of 9·7 per cent, was in mineral traffic. The slight drop in coal and coke receipts was to be expected, as this traffic rose only in the latter part of 1960. The rise of 1·6 per cent in merchandise and livestock seems a poor reward for the energy spent on fixing rates and improving services. Merchandise receipts, no doubt, will increase with further knowledge of transport costs and with improved services, more confidence in quoting for traffic in the face of competition. As it is, a good many rates seem to be too low, though it is impossible to say whether a higher quotation would have lost the traffic to the railways. Freedom in rate quotation and the science of costing are still so recent that much more experience is needed before railway commercial officers can determine charges which both secure the

traffic and afford a reasonable margin over the cost of movement. The preference of many potential railway users for movement in their own road vehicles is a factor influencing quotation of railway rates.

	Four weeks to		Incr. or decr.	Aggregate for 52 weeks to		Incr. or decr.
	Jan. 1, 1961	Dec. 27, 1959		Jan 1, 1961	Dec. 27, 1959	
	1960 £000	1959 £000	£000	1960 £000	1959 £000	£000
Passengers—						
British Railways ...	11,250	10,400	+ 850	150,542	139,644	+ 10,898
London Transport—						
Road passenger services	4,144	4,276	— 132	56,571	54,940	+ 1,631
Railways	2,072	2,002	+ 70	26,219	24,010	+ 2,209
Provincial & Scottish buses	4,336	4,225	+ 111	61,796	60,684	+ 1,112
Ships	347	265	+ 82	7,370	7,454	— 84
Total passengers ...	22,149	21,168	+ 981	302,498	286,732	+ 15,766
Freight, Parcels & Mails—						
†British Railways—						
*Merchandise & livestock	7,434	7,859	— 425	102,027	100,392	+ 1,635
*Minerals	3,672	3,724	— 52	48,982	44,635	+ 4,347
*Coal & coke	8,296	8,729	— 433	108,737	108,898	— 161
*Parcels, etc., by coaching train	4,236	4,319	— 83	56,164	54,222	+ 1,942
*Total freight British Railways	23,638	24,631	— 993	315,910	308,147	+ 7,763
Others	4,302	4,217	+ 85	58,002	55,565	+ 2,437
Total freight, parcels & mails	27,940	28,848	— 908	373,912	363,712	+ 10,200
Total	50,089	50,016	+ 73	676,410	650,444	+ 25,966

* Includes receipts from collection and delivery, etc.
† Receipts from railway movements wholly within dock areas, included in previous periods under "Freight, Parcels and Mails," are now classified as miscellaneous.

In view of the growth of private road passenger vehicles, passenger traffic receipts of the British Transport Commission rail and road undertakings can be said perhaps to have held their own, but no more. Provided that plans can be implemented for further improvement of services, the outlook for British Railways passenger traffic is reasonably good.

The incidence of the Christmas holiday vitiates comparison between the last four-week periods of 1959 and 1960, of which the dates do not correspond.

PERCENTAGE VARIATION 1960 COMPARED WITH 1959

	Four weeks to January 1, 1961	52 weeks to January 1, 1961
British Railways :		
Passengers	+ 8·1	+ 7·8
Parcels	— 1·9	+ 3·5
Merchandise & livestock	— 5·4	+ 1·6
Minerals	— 1·3	+ 9·7
Coal & coke	— 4·9	— 0·1
Total	— 0·4	+ 4·2
Ships (passengers)	+ 30·9	— 1·1
British Road Services, Inland Waterways & Ships (cargo) ...	+ 2·2	+ 4·3
Road Passenger Transport, Provincial & Scottish	+ 2·6	+ 1·8
London Transport—		
Railways	+ 3·4	+ 9·2
Road services	— 3·0	+ 2·9
Total	— 0·9	+ 4·6
Aggregate	+ 0·1	+ 3·9

Transport in Parliament

TRANSPORT matters will occupy a considerable amount of its time when Parliament reassembles next week. In fact, the Minister of Transport, Mr. Ernest Marples, will find so much on his plate that it is questionable whether it can all be digested. Legislation for construction of an underground garage in Hyde Park, a Road Safety Bill, and one to authorise Government assistance for building the new Cunarder liners are to be introduced shortly by him. Unfortunately the major legislation implementing the Government proposal contained in the White Paper on the re-organisation of the nationalised transport undertakings is to be held over until next session, for reasons which are not convincing. It cannot, therefore, be implemented until mid-1962. This is regrettable, for the delay condemns the British Transport Commission and its undertakings to a further period of uncertainty and indecision, and must postpone the day when the railways can hope to pay their way again. The effect on the staff can only be harmful.

The Minister, in the meantime, will face a barrage of Parliamentary questions on Wednesday, and the House of Commons is to debate the Government proposals on January 30. It is essential that Mr. Marples responds to the pressure exerted by Members and that he clarifies the intentions of the White Paper. This amounts to little more than a bare outline, and even that is deplorably vague. Parliament would be failing in its duty if it did not demand such clarification, and also more information as to what interim steps are being taken by the Minister. Meetings of Mr. Marples' advisers are understood to be taking place, as reported last week; but, as with those of the Stedeford group, they are being held behind closed doors. The Minister must discharge his constitutional responsibility to Parliament by meeting its challenge in these respects.

The Opposition is so critical of the re-organisation scheme as it stands. There will be considerable difficulty in convincing it that the proposed structure, involving the abolition of the Commission, appointment of the various boards, and the interposition between them and the Minister of an Advisory Committee, of which he is to be Chairman, fulfils the Government's purpose. The White Paper defined this as aiming at placing the nationalised transport undertakings on a sound basis both in organisation and finance. The Opposition asks what difference there is between the British Railways Board, and the old Railway Executive; or between the managerial boards for the other undertakings, and the former Executives of the Commission, all of which, except the London Transport Executive, were abolished by the Conservative Government. It also wishes to know what function the Nationalised Transport Advisory Council is to perform, that the Commission itself failed to carry out. The purpose of the Council is stated to be direct contact between the Minister and the main components of the nationalised transport industry. Many M.P.s are said to find it hard to understand where the streamlining of the structure comes in. With its establishment of the Council, and despite the demise of the Commission, there will be as many bodies to be informed and consulted as before. Increased power is given to the Minister, with his responsibility for the appointment of the chairman of the several Boards, and his own chairmanship of the Advisory Council. This, despite the disclaimer in the White Paper, could cause the delay and greater Ministerial interference of which the Select Committee on Nationalised Industries was so critical. While these are major criticisms on which clarification and justification are needed, and are rightly being sought by Parliament, some advantages are seen in the further decentralisation envisaged, to the small extent to which that still seems possible without handicapping British Railways in its operation as a single entity, and in the greater commercial freedom to be provided, more particularly with the curtailment of the powers of the Transport Tribunal as to charges.

The financial proposals also are generally welcomed; but there is considerable doubt in some Parliamentary circles whether, despite the writing-off of accumulated losses and the capital transfer to suspense account, the railways will be able to earn sufficient to meet the £60 million interest charge which it is estimated will remain. This means that the present operating loss of £60 million must be converted into a net operating surplus of £60 million before the railways cease to lose money. Net revenue must improve by £120 million before this is achieved. Five years is the period given, but the extent to which the aim can be accomplished depends on the speed with which the reconstruction is effected, and on the rate of modernisation. On this Government action is inexplicable. Delay over the former is bad enough without added uncertainty as to the extent to which implementation of the present modernisation programme is to be allowed to continue, and at what

speed. It is illogical to give financial aid on the scale envisaged, so as to put the Commission's finances on a realistic basis to enable it to pay its way and then to deny it the only possible means whereby it can do so. There is a very strong case for speeding up modernisation and none for slowing it down, let alone postponing or cancelling schemes already started, such as the Euston to Birmingham, Crewe, and Liverpool electrification. A Ministerial decision on the future of the programme is as urgent as clarification of organisational proposals. It is to be hoped that it will be postponed no longer and will be announced during the Parliamentary debate.

Electrification in South Africa

THE end of the approved electrification programme to which the South African Railways Administration has been working is now in sight. Originally, some £20,000,000 was provided for electrification and nearly £15,000,000 has already been spent. The main work currently in progress is the electrification of the Touws River-Beaufort West section of the Cape Town-Johannesburg main line, while smaller projects in Natal and on the Cape Suburban System (the lines to serve the non-white areas) are well advanced.

The last financial year, which ended on March 31, 1960, was a record one for electrification. During the year, 239 route miles of electrified track were added, bringing the total to 1,199.

The electrification of the 179-mile section between Touws River and Beaufort West on the Cape main-line is the longest single stretch ever to be undertaken by the South African Railways. Supply depots have been opened at Beaufort West and Laingsburg and preliminary work has been completed. Electric locomotives will be hauling trains northwards as far as Leeugamka by July, 1961, while the whole £3,000,000 project is planned for completion before the end of 1961, which will mean electric traction over a distance of 339 miles from Cape Town.

The electrification of the Cape Town suburban lines and of the sections Cape Town-Langa-Nyanga-Bontheuwels-Nyanga and Bontheuwels-Kasselsvlei-Bellville is scheduled for completion before the end of 1961. A total of 222 route miles will be added to the electrified network in the Cape when the work now in progress is finished.

In the Transvaal 126 route miles of electrification were added during the year ended March 31, 1960, the two longest sections being Midway-Vereeniging (including Residensia-Grasmere) 33 miles, and Wattles-Vereeniging, 30 miles. The lines serving the coalfields of the Eastern Transvaal from Oogies to Broodsnyersplaas and Welgedag to Witbank have been electrified at a total cost of £2,690,900. This electrified section will be opened to traffic this year.

The increase in electrified route mileage in the Transvaal and Orange Free State for the year totalled 210 and electrification now extends from Witbank on the east to Klerksdorp in the west and from Pretoria in the north to Kroonstad in the south.

A route mileage of 42 was added to the electrified network in Natal during 1959-60 with the opening to traffic of the Rossburgh-Cato Ridge (*via* Hillcrest) section. The authorised electrification programme for Natal includes the Durban-Duff's Road and Umgeni-Duff's Road sections, which are planned for completion before the end of 1961.

Natal has the longest single stretch of electrified track in the Union at present. The Johannesburg-Durban main-line is electrified from Durban to Volksrust on the Transvaal border, a distance of 321 miles, while to the Orange Free State electrification extends as far as Harrismith, 263 miles from Durban.

Up to the end of March, 1960, electric locomotives had run a gross total of 452,065,583 miles and motor coaches 376,340,001 miles since the introduction of electric traction on the South African Railways in 1926. The highest mileage recorded by any one electric locomotive was 2,654,816 and that of any one motor coach 1,823,345.

The ton-miles operated under electric traction increased from 11,933 million in 1958-59 to 14,330 million in 1959-60. The number of suburban passenger journeys on the Cape Town and Witwatersrand electrified services increased from 215,987,996 to 232,956,691.

The electric locomotive buying programme has been an impressive one. During the 1959-60 financial year, 80 electric locomotives were placed in service bringing the total at March 31, 1960, to 472. Between April 1, and November 30, 1960, a further 46 were added while 42 are on order and will be in service by the end of May, 1961.

The Burma Railways in 1958–59

FOR the Burma Railways, the 12 months ended September 30, 1959, were a boom period, according to the annual report of the system for that year which we have received recently from Kyi Win, Commissioner of Railways. The greatly improved security conditions resulting from the change of Government enabled the Railway Administration to resume night running of trains, thereby cutting down the turn-round of rolling stock and increasing track capacity. This, coupled with increased efficiency, brought in unprecedented traffic earnings. A contributory factor was completion of the Rangoon Circular Railway.

Gross earnings were K.1043 lakhs, made up of K.447 lakhs from coaching, K.577 lakhs from goods working, and K.19 lakhs miscellaneous, increases respectively of K.75 lakhs, or 20 per cent; K.59 lakhs, or 11 per cent; and K.8 lakhs, or 73 per cent. Total working expenses, including depreciation, interest charges, and reserve fund allocation, amounted to K.844 lakhs, K.10 lakhs more than in 1957–58. The net earnings contribution of Burma Railways was the creditable sum of K.199 lakhs, more than ever achieved before either pre-war or post-war. Of this sum, 50 per cent has been set aside for income-tax.

The increase by over 6·8 million to 33·7 million in passenger journeys was due to the vast improvement in security conditions and the concerted drive which virtually eliminated ticketless travelling. Goods traffic tonnage has been rising steadily, and for the latest period was not far short of 3 million tons, against 2·76 million in 1957–58. Total ton mileage increased from 386 million to 432 million.

During the year there were only 35 cases of sabotage by insurgents, 24 fewer than in the previous year. Only four bridges were damaged, after 51 in 1957–58, and over 100 in 1956–57.

To help the Government in its campaign to bring down the cost of living index, a reduction of 20 per cent on freight rates for 31 commodities was made, mainly agricultural products and food items. Referring to the requirements of the depreciation reserve fund, and to the repayments of the World Bank loan, the Commissioner says that although the future of the railways looks very bright, there is no room for complacency, and the present commendable effort must be sustained if not increased. The total number of staff and employees rose to 23,638 at the end of the year, compared with 21,812 at September 30, 1958.

Diesel crankcase oils

TWO papers presented earlier this week at a meeting in London of the Institution of Locomotive Engineers, both of which deal with specialised aspects of quality control for diesel-engine lubricating oils, combine to underline the importance of preventative maintenance for all forms of railway diesel motive power.

The conditions to which crankcase oils in diesel engines are exposed are conducive to a rapid rate of change in properties during service. Apart from oxidisation products associated with high-temperature operation, the oil can also become contaminated with neat fuel oil and the products of its incomplete combustion, water, wear-metal particles, the residue of

air-borne solids which may pass the air filter, and degradation products of oil additives. According to Mr. S. Bairstow, in his paper "Control of quality of crankcase lubricating oils of locomotive diesel engines in service," where large numbers of diesel engines are concerned as in railway service, the examination of used lubricating oil must be capable of being made on a routine basis and the results must be quickly available if effective action is to be taken on them. Because greater-than-normal fuel dilution and water can appear suddenly in an oil and increase rapidly, the reason for their presence in a main-line diesel locomotive engine could require immediate investigation. On the other hand, the build-up of insoluble matter, additive depletion, and oil oxidation are slower processes which require less frequent inspection. Practical experience on British Railways quoted by Mr. Bairstow shows that shunting locomotive depots should be equipped to enable oil samples to be tested for fuel dilution and water on the occasion of each 10–16-day examination. Also a "blotter" test should be applied there as long as its scope for detergent oils is strictly limited to an indication of retention of dispersion properties, and depletion in the case of alkaline additive oils. Samples should be sent away for testing in the laboratory at about yearly intervals coincident with the appropriate mileage examination. For main-line locomotives, samples should be tested at depots for fuel dilution and water daily, and the "blotter" test applied each week. Samples for examination in the laboratory should be taken from a representative number of the engines of main-line locomotives in each class at intervals of 5,000 miles, or one month, whichever is the shorter period.

The direct determination of fuel dilution is not feasible and, of the two alternative procedures available for use in depots, the method of comparing oil viscosities with a known standard is preferred to that of determining the closed flash point. The latter is a more tedious operation and it is more difficult to estimate the amount of fuel dilution from the value obtained. In fact the actual values of viscosity and flash point can easily be misinterpreted and are not so useful to the maintenance engineer as are conclusions which can be deduced from them by a specialist concerning the fuel-dilution trend. For the detection of small quantities of water, a method has been devised by British Railways whereby the intensity of light from a detector bulb is noted two min. after a pair of electrodes in the same electrical circuit, with a pre-set gap, has been immersed in the sample. The bulb filament just glows red when 0·5 per cent of water is present; with one per cent it gives a bright emission. Further indications are that the filament will begin to glow after about 30 sec. if the water content is in the region of one per cent and an immediate glow is definite evidence of the presence of more than one per cent. Because of the fact that water entering the crankcase from the cooling system of an engine in normal service is continuously evaporated, the finding of as little as 0·5 per cent in a sample taken while the oil is still hot calls for an immediate examination of the engine for substantial internal leaks. The adoption of limits for all aspects of lubrication quality is obviously a necessary part of the system of control, and suggestions for these are set out in the paper, but Mr. Bairstow stresses that they should not be the whole system. The routine serves only as a skeleton to be enlivened and made really effective by rapid interchange of information between depots and laboratories, giving early warning of trends which may lead eventually to abnormal conditions unless corrected.

The need for exact and speedy information regarding the wear particles carried in the engine lubricant led to the application of spectrographic analysis as a supplement to the conventional laboratory tests. This subject is dealt with comprehensively in Mr. G. M. Barrett's paper "Spectrographic analysis of crankcase lubricating oils as a guide to preventative maintenance of locomotive diesel engines." Even with well-established engines for which the manufacturer may recommend definite overhaul periods based on operating experience elsewhere, differences in average loading and operating conditions may enable the operator to extend these periods with safety with the aid of the spectrograph. After a railway has gained considerable background experience of diesel traction, the spectrographic control of engine condition may be likened to a form of insurance against untoward failures. The cost of the premium, in this case the expense of collecting and analysing samples and the contribution to laboratory overhead costs, has to be considered in relation to the possible frequency of engine failures and the financial losses which they might cause. Bearing in mind that the cost of repairing a diesel engine after a major breakup is probably more than proportional to its horsepower, every railway would be advised to work out for itself the minimum size below which there is no longer an economic justification for exercising spectrographic control. For those yet without experience, Mr. Barrett suggests that, on an average, the minimum size may be around 1,000 h.p., but he adds that the severity of the engine rating set by the manufacturer and the variables in operating conditions could result in wide divergencies above or below this figure.

Although the significant point to look for is a rise in concentration of such metals as iron, chromium, copper, lead, aluminium, tin, silver, and silicon above a previously established level, major American diesel locomotive manufacturers publish lists showing recommended maximum concentration limits as an initial guide to their customers. Some manufacturers have extended this idea by establishing a range of metal concentrations each of which calls for a different appropriate action by the engine user. The compilation and use of charts giving such information is really only possible where very large numbers of identical locomotives are operated intensively under generally similar conditions. On some railways in the U.S.A. the numbers of oil samples analysed per day are so many that, Mr. Barrett contends, there may not be time for the staff to compile and examine a graphic record for each locomotive concerned to look for trends. It is in such circumstances that manufacturers' charts have their greatest value. It calls for no technical knowledge in the control office if it is only necessary to check the actual concentration, reported by the laboratory, against an arbitrary scale and then to read off and pass the appropriate action instructions to the locomotive running shed.

LETTERS TO THE EDITOR

THE EDITOR IS NOT RESPONSIBLE FOR THE OPINIONS OF CORRESPONDENTS

EXPENDITURE ON RAILWAYS AND ROADS

January 5

SIR, In an editorial note in your December 2 issue you decry the amount spent by the Minister of Transport, Mr. Ernest Marples, on roads, and his economising of expenditure on railways, and you accuse him of "openly favouring one aspect of his responsibilities."

May I point out that for many years the favours have been conferred on the railways, and at the expense of the motorist? The important point is this: any expenditure on roads is amply paid for by the motorist through a special tax, the Road Fund Tax, which, I believe, brings in about £3 million a week. Of this, only about 14 per cent has been used on the roads. So the motorist, surely, is only just beginning to get a fair deal.

In contrast, the present vast expenditure on the railways is a direct charge on the taxpayer, including the motorist, whether he travels by rail or not. The mere fact that the railways cannot pay for their own modernisation out of profits is a serious factor against them.

If this spending on railways can make them into a profitable concern, well and good. But British Railways is estimated to be losing about £60 million a year, and in 1959, when the deficit on the railways was nearly £42 million, the net receipts of the

road transport undertakings of the British Transport Commission totalled some £14 million. It is understandable, therefore, that Mr. Marples should consider roads a good investment. That is how rival systems should be assessed: on efficiency and economy, not sentiment.

Yours faithfully,

J. WHITE

501, Gloucester Road,
Horfield, Bristol, 7

BRITISH RAILWAYS ASSESSED

December 27

SIR, The current standard of service provided by British Railways is neither as wholly disgraceful as some of your recent correspondents would have us believe, nor as unexceptionable as your editorial vindications would make out. As a frequent traveller on both British and Continental railways and an economist interested in railway technology, I should like to present a more balanced assessment.

Taking the good aspects first, it can hardly be denied that British second class passenger accommodation is the most comfortable in Europe, nor that the London suburban services —especially those of the Southern Region—are second to none in comfort, speed, frequency and reliability. The frequency and speed of the main-line services to and from London is also commendable, while British restaurant and buffet car services though not as good as their West German and Swiss counterparts, give much better value for money than the services that the Wagon-Lits company operates in other Continental countries—and, may I add, than the services provided in this country by the Pullman Car Co. Ltd., whose much vaunted " goodwill " I find very hard to understand.

Against this it must be said that connections between main-line and cross-country services are mostly very poor, while the sloppy presentation, lack of clarity, late appearance, frequent alterations and non-observance in practice of British railway timetables are nothing short of disgraceful. None of these defects can be excused in any way either by post-war restrictions on capital development, or by the interference to normal operation caused by modernisation. The current quality of the track, density of line occupation, temporary and permanent speed restrictions, determine whether trains can be run at 30, 60 or 90 m.p.h., but at any of these speeds trains can be run punctually provided the timetables are realistic and provide adequate margins for unforeseen contingencies, including engineering on the line. That is the secret of German, Swiss and French punctuality. If only British timetable planners would remember that passenger services are run primarily for the benefit of the travelling public, they would time main-line services at speeds which could be punctually observed at all times and make the frequent supplements to timetables unnecessary. As for the sloppiness, lack of clarity and frequent late appearance of the public timetable books, that too could be avoided if British Railways printed their timetables themselves instead of contracting them out to the cheapest private printer recruited by competitive tender. It would be a more expensive procedure, but British Railways would more than recoup their extra costs by the increased public goodwill derived from better printed timetables, particularly if they could then make use of the easily understandable railway symbols commonly used in Continental timetables.

The same mixture of the excellent and the outrageous is to be found in the execution of the modernisation plan. Its general principles—dieselisation preceding electrification, frequent passenger services by multiple-unit trains and locomotive hauled expresses—could not be bettered, but the details of its execution have been unbelievably wasteful. Instead of combining the economies of ordering the most up-to-date equipment with the economies of maximum standardisation, the B.T.C. has ordered a profusion of different designs—20 types of main-line diesel locomotives, 10 types of diesel multiple units—a majority of which were technically more than 10 years out of date in their poor power/weight ratios. The standard British Railways passenger carriage is at least 20 years out of date in its conception of resting the whole weight on a separate infrastructure, which makes it some 40 to 50 per cent heavier than need be. The opportunity of standardising the buckeye coupling for all types of railway rolling stock has been missed, and the old-fashioned combination of buffers, with screw-thread-chain couplings that need to be coupled and uncoupled by hand, has been perpetuated in, of all places, the new diesel multiple-unit trains where a quick and efficient automatic coupling should have been regarded as essential. Apart from their couplings, the structure and lay-out of the passenger accommodation of the diesel sets is excellent, but this only highlights the unnecessary weight and unimaginativeness of the designs for the electric and diesel-electric multiple-unit sets recently introduced on the Southern, Eastern, and London Midland Regions. And why have 10 different designs of diesel sets, many of which cannot be run in multiple with each other, when three designs (one express, one cross-country, and one suburban) would have been perfectly adequate? The breakdowns and dislocation that have followed the introduction of the dieselised St. Pancras and Paddington suburban services, and the electrification of the Liverpool Street and Glasgow suburban services have also made it painfully clear that British Railways have been introducing new equipment before it has been adequately tested.

I don't think that any of these defects can be blamed on nationalisation. It would appear to be a combination of inadequate staffing at the centre, a lack of moral fibre on the part of the members of the B.T.C. in resisting the pressures of private railway equipment manufacturers, and—among the operating departments—of that typically British prejudice against new ideas and the disturbance of established routines.

Yours faithfully,

F. E. LAMOND

13, Heath Street, Hampstead, N.W.3.

RIDING QUALITIES OF PASSENGER VEHICLES

January 16

SIR, I was most interested in Mr. Clinker's letter in your issue of December 23, particularly as his observations are based on his personal experience between Rugby and Crewe over the past 35 years and a genuine interest in the welfare of the railway. I would, however, like to make some comments about the track, this being my responsibility.

During the past two years the heaviest programme of major track work in the history of this length of line has been actively in hand and has included deep re-ballasting, track drainage, blanketing of the clay formation where this has been broken down and puddled by the pounding of traffic over the years, and also re-alignment schemes. To date, something like 75 per cent of the Up and Down fast lines between Rugby and Crewe have been dealt with, and increased passenger comfort at high speed will be among the dividends to be derived from this work. There will also be an economic dividend in reduced future maintenance, which will be dealt with on a pre-planned programme basis without the need to give frequent attention to " sore spots." The full benefit of this work will not be felt until the ballast has properly consolidated.

We are, therefore, in the throes of those track improvements to which Mr. Clinker refers in the last paragraph of his letter, and I hope he will be travelling between Rugby and Crewe for some years to come and that he will soon feel the benefit of the work that is now being done.

Yours faithfully,

ARTHUR BUTLAND
Chief Civil Engineer

London Midland Region, British Railways,
Stephenson House, 67/87, Hampstead Road,
London, N.W.1.

The Scrap Heap

Breaking the fall

Speeds of up to 40 m.p.h. were reached on the St. Petersburg to Tsarskoe Selo line (steam-operated from 1837) and two trucks of sand were thoughtfully provided next to the engine for the reception of passengers, who, it was believed, would become air-borne in the event of a sudden stop.—*From "Russian Steam Locomotives," by H. M. Le Fleming and J. H. Price* (John Marshbank, 25s.).

New locomotives for children's railway

Budapest's Pioneer Railway, which, with the exception of engine drivers and stationmasters, is staffed entirely by children, is to get six new streamlined 270-h.p. diesel locomotives this year. First of the locomotives, which are being made in the Wilhelm Pieck Wagon Works, will be handed over in the spring.

Victoria reconstruction ?

The scheme to rebuild Trafalgar Square under Victoria Station, and to rebuild Wembley Statium on top of it, with a multi-storey car park and youth centre on top of that, has great possibilities. Objectors have raised the question of the Nelson Column. The answer is that if the Square were at a sufficient level below ground, the statue of Nelson would appear at eye level opposite the Continental Booking Office and would be more generally noticed than it is now. To attract tourists it could be painted in bright colours and might form the nucleus of a design symbolising the multiracial Commonwealth.—*Peter Simple, in "The Daily Telegraph."*

All change

"At one time, a teacher belonged to a school. Now many schools are like Victoria Station. People just go there to move on to other places."—*Rt. Rev. John Heenan, Roman Catholic Archbishop of London.*

Well matured

A recent illustration in the *Daily Telegraph* showed part of the label attached by the London branch of a Scottish whisky firm to a case sent to a client in Sussex. The label read: "per *L.B. & S.C. RLY* carriage paid." As the *Daily Telegraph* writer justly pointed out, the London, Brighton & South Coast Railway ceased to have a separate existence in 1923, when it was merged with the former Southern Railway. Plainly, their product makes the distillers much preoccupied with vintages.

Better safe than sorry

Princess Margaret and her husband went to Sandringham last Saturday, their train was hauled by an eight-year-old steam engine "Rudyard Kipling," and arrived only two minutes behind schedule. It would seem that British Railways were anxious to avoid a repetition of the incident on the previous Wednesday when the Queen's train to Sandringham, hauled by a new diesel engine, which broke down, arrived 56 min. late. The train, which brought the Queen back to London from Sandringham, was on time—it was hauled by a steam engine.

Cartoon] ["*News of the World*"

Merry-go-round

For a few weeks during the summer of 1808, Trevithick's "steam circus" in Euston Square was a great outdoor attraction for Londoners. For only a shilling they rode round a circular track in an open carriage hauled by a steam locomotive. On a pamphlet advertising the circus was a print of the machine, described as a "Portable Steam Engine" and labelled "Catch me who can." Below the print was a caption which read: "Mechanical Power Subduing Animal Speed." The circus came to an abrupt end when one of the wheels of the locomotive broke, and the engine overturned. Fortunately no one was hurt.

Time and motion study

Recently Watches of Switzerland Limited devised a unique ordeal for one of their products. It was strapped firmly with surgical tape to the base of one of the rails at Clapham Junction, British Railways, Southern Region, from 3.30 p.m. to 7.30 p.m. During this time 80 trains with a total weight of approximately 30,000 tons passed over the watch at intervals as frequent as 2½ min. at the height of the peak period. When the watch was removed it was found to be working perfectly and the movement was in faultless condition.

Watch being strapped to rail for vibration tests

OVERSEAS RAILWAY AFFAIRS

FROM OUR CORRESPONDENTS

NEW ZEALAND

Bulk cement traffic

Bulk cement has been railed for the first time by the Government Railways. It was carried in pressurised containers and blown out into silos at a siding at the consignment's destination.

SOUTH AFRICA

Progress on Durban Project

Major construction work is in progress in the Durban central area on a project scheduled for completion in 1963 and costing some £3,630,000, of which £1,140,000 has already been spent. The work involves the quadrupling of the passenger lines between Durban and Booth, which is the south coast line junction just to the north of Rossburgh, at an estimated cost of £2,105,000; the building of an additional double line from Alice Street to Dalbridge at a cost of £1,205,000 to take trains for non-whites from the Kwamashu Settlement near Duff's Road, approximately nine miles from Durban on the north coast line; and the clearing of a site through the Congella marshalling yard for the National Freeway road from Durban to the south coast, and the provision of fly-over bridges to take the tracks over the Freeway, at an estimated cost of £320,000. The Durban Borough Council will pay for the road.

Bridge replacement programme

Eleven old steel railway bridges, built on the south coast of Natal between 1897 and 1901, are being replaced by reinforced concrete bridges at an estimated cost of £1,132,556. The last bridge on the programme, at Mtwalume, is expected to be completed in the first half of 1962. This will bring the number of bridges reconstructed in recent years between Kelso and Port Shepstone to 19. The replacement of these bridges on one of South Africa's holiday coast lines has enabled the Railway Administration to improve railway travel by speeding up services.

RHODESIA

Communications disrupted by elephants

Rhodesia Railways telecommunications route between Wankie and Entuba was extensively damaged by elephants early in the morning of December 24. All telephone and telegraph lines and the C.T.C. wires were knocked down for a third of a mile, and eight steel poles were so badly bent as to require replacement. Although the loss of communications was reported at Dett shortly before 1 a.m., a delay was experienced in contacting staff at Wankie as the elephants had also damaged the post-office lines. The Railways' C.T.C. and telephone circuits were restored at 6.30 a.m. and other circuits were progressively restored until all were in operation by 6 p.m. on Christmas day.

INDIA

Proposed new link with Kashmir

The Railway Board recently sanctioned civil engineering and traffic surveys for a broad-gauge line, about 100 miles long, from Kathua to Jammu. The work is being done by staff of the Northern Railway. The proposed line would facilitate movement of goods between the State of Jammu & Kashmir and the rest of the Republic of India.

New goods terminal near Bombay

A large goods terminal has been proposed for the Bhandup-Vikhroli area near Thana, to serve industrial plants in the outer Bombay area.

Bombay suburban services

Additional services at peak hours are to be introduced as new multiple-unit electric stock is delivered for Central Railway services in the Bombay area. Proposals have been made for lengthening station platforms and re-locating signals, to facilitate introductionof nine-car trains.

PAKISTAN

United Kingdom loan

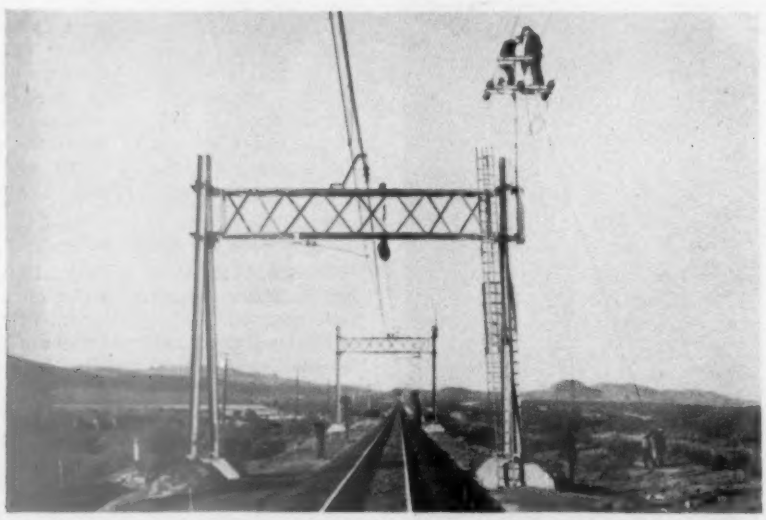
The United Kingdom Government has approved a loan of £3,000,000 to Pakistan for the purchase of railway wagons from the U.K., to meet urgent requirements for development of the railways as part of the second Five-Year Plan.

BRAZIL

Locally built passenger coaches

The first batch of stainless steel passenger coaches, built in the Araraquara Railway workshops, has been put into service. They are for 5-ft. 3-in. gauge, measure 84 ft. in length and are built of local materials, except wheels and axles,

ELECTRIFICATION IN SOUTH AFRICA



Construction work in progress on Touws River-Beaufort West line, South African Railways (see editorial reference on page 68)

which are imported. First class coaches have seating for 66 passengers, with revolving and reclining armchairs and individual lighting for each. Second class coaches have accommodation for 72, with simplified seats. Restaurant and baggage cars are now being built.

Sao Paulo train fares

As from January 1, passenger fares have been raised on the Sorocabana, Paulista, Mogiana and Noroeste Brasil railways. Percentage increases vary on the different lines, but in general amount to 40 per cent on short distance and 16 to 18 per cent on long-distance journeys.

ITALY

Simplon main line doubling

With the completion of the doubling of the Simplon line over the 16½ miles between Gallarate and Arona, which has been financed with Swiss capital, this main line is now double throughout between Domodossola and Milan. The branch from Arona through Alexandria to Genoa also has recently been electrified, and to relieve the main station at Milan, certain international trains are to be diverted over this route. They will include the 6.14 a.m. from Basle (8.5 a.m. from Berne by the Lötschberg route), with through coaches from the Hook of Holland to Ventimiglia, which will reach Genoa 1¼ hr. earlier, at 3.17 p.m. In the reverse direction the start of the same train from Genoa will be 34 min. later, at 2.26 p.m.

BELGIUM

Train derailed by saboteurs

On January 8, rail traffic between Liege and Verviers was stopped when saboteurs derailed a passenger train in a tunnel between the two towns. Bolts on the rails had been unfastened and the engine and first carriage left the track. None of the passengers or crew of the train suffered injury.

SPAIN

C.T.C. extended

C.T.C. has been brought into service between Leon and Vega Magaz, so that the whole of the 80-mile Leon-Ponferrada section of the Palencia-Corunna main line is now so equipped. The first C.T.C. installation on the R.E.N.F.E. was completed six years ago, between Brañuelas and Ponferrada, on the same main line.

SWITZERLAND

Furka-Oberalp Railway

Since 1925, the Furka-Oberalp Railway has been under the same management at Brique as the Visp-Zermatt and Gornergrat Railways, but with the retirement of the present Director of the group, Mr. P. Schneller, the Furka-Oberalp Company has decided to manage its affairs independently, with those of the Schöllenen Railway from Göschenen to Andermatt. The reason given is that the problems to be faced by the various members of the group differ considerably.

The Visp-Zermatt-Gornergrat lines carry mainly a tourist traffic, whereas the Furka-Oberalp and Schöllenen lines, linking the Simplon and Gotthard main lines with the Rhaetian Railway at Disentis, have an importance from the through traffic point of view. Hitherto there has been interchangeable use of locomotives and rolling stock between the Furka-Oberalp and Visp-Zermatt lines, both of which are equipped for rack-and-pinion working over the steepest sections.

PUBLICATIONS RECEIVED

Russian Steam Locomotives. By H. M. Le Fleming and J. H. Price. London: John Marshbank Limited, 90, Ebury Street, S.W.1. 9¾ in. by 6 in. 100 pp. Fully illustrated. Price 25s. Apart from the historical interest, this is an admirable short guide to modern Russian practice in the design of steam locomotives and gives useful information on other aspects of railways in the U.S.S.R. It is believed to be the first in the English language devoted to its subject. British builders played an important part in supplying engines for the various railways of Imperial Russia, beginning with a Hawthorn 2-2-0 delivered in 1837 to the 14-mile line from St. Petersburg to Tsarskoe Selo, the first public railway in the country. Events thereafter until the 1917 revolution are succinctly described in a chapter of very great interest. The last new steam engine was completed in 1956. The question of motive power in the U.S.S.R. is discussed in a chapter " Taking Stock." Condensing and experimental locomotives are among the many subjects described.

L'Exploitation Technique du Chemin de Fer: La Sécurité du Transport (*Safety in Railway Operation*). By André Lemonnier. New edition. Paris 5e: Editions Eyrolles, 61, Boulevard St. Germain. 176 pp. 10 in. x 6½ in. Paper covers. Illustrated with photographs and diagrams. Price 20.20 N.F., post free. The author, who holds the rank of *Ingénieur en chef honoraire* of the French National Railways, has taken cognisance of the many developments in signalling and allied spheres since the first edition was published in 1945. He first discusses types of movement accident. Safety devices and rules, and basic principles are dealt with, but no attempt is made to describe complex apparatus in detail which would be of interest chiefly to technical staff. The chapter on signal-boxes has been re-written. The preface is by the late Monsieur Jean Goursat. The book is intended mainly for station, footplate, and signalling and other operating staff of the S.N.C.F. Besides French practice and equipment, brief reference is made to those of railways outside France. To railwaymen in many countries it will be a valuable guide to modern French practice in signalling and safety measures.

Goods by Air.—A list of stations of British Railways and the Ulster Transport Authority serving major airports in the United Kingdom, with indications of daily delivery services from station to airport, is given in a booklet, " Goods by Air." Also included is a list of railway commercial officers and their addresses. The booklet is intended as a guide for those who have not used air transport and as a handbook for those with experience. It deals briefly with subjects such as scheduled and charter services and the basis for cargo rates. Copies, price 2s. 6d. post free, are available from the publishers, Chamber of Commerce Publications, 68, Queen Street, London, E.C.4, or from any chamber of commerce affiliated to the Association of British Chambers of Commerce.

Air-conditioning Equipment. A series of pamphlets and reprints, some with text in German and some with text in English, describe and illustrate the Jettair air-conditioning system applied to dining-cars, sleeping-cars, diesel trains, and passenger coaches in Europe and Asia, and also air-conditioning plants for buildings, as made and installed by Luwa G.m.b.H., Frankfurt, Germany.

Holiday Cruises. British Railways s.s. *Duke of Lancaster*, 5,085 tons gross, is one of many ships in the 1961 cruising programme of Thos. Cook and Son Ltd. and Dean & Dawson Limited. From Heysham there will be 10-day cruises to the Scottish Lochs on May 6 and September 16, and a 12-day trip to North Sea ports on May 23. From Harwich the *Duke of Lancaster* will sail on June 6 and 14 on cruises to Amsterdam, Antwerp, and Ostend (six days), and to Amsterdam, Esbjerg, and Bergen (12 days) respectively.

OBTAINING A SMOOTH-RUNNING BOGIE—2*

Improving the conventional type as used on multiple-unit and locomotive-hauled stock by a basic approach to its faults

BY A CORRESPONDENT

PART I of this article dealt only with the requirement that a bogie should not transmit shocks caused by track imperfections. It is also vital that the bogie should not manufacture movements of its own which are not the fault of the track. Before considering this aspect it may be noted that many designs in wide use today, even in the best condition, would ride badly at speed on the most perfect welded track; they would manufacture their own lateral oscillations.

Each pair of wheels fixed on its axle is allowed a limited lateral movement between the rails, the actual amount being between $\frac{5}{16}$ in. and about $\frac{3}{4}$ in. either side of the central position as the tyres and rails vary from new to fully-worn conditions. This freedom allows some track misalignments to be avoided in the same way that a motorcar driven on a winding road can cut the corners instead of exactly following the curves.

In theory, this lateral freedom of the wheels also allows the conicity of the tyres to exert a steering effect and so keep the flanges from touching the rails. In practice, any advantages are more than counterbalanced by the manner in which the tyre coning and the lateral clearance between the flange and rail can combine to cause violent lateral oscillations.

Natural snaking action

A pair of wheels runs with a natural snaking action as shown in Fig. 6. This is understandable when it is realised that if, for example, a new pair of wheels is displaced sideways $\frac{1}{4}$ in. from the central position (which is not far enough for the flange to contact the rail), the 1-in-20 incline of the coned portions of the tyres will cause one wheel to run on a slightly larger diameter than the other and travel over $\frac{1}{8}$ in. farther after only two revolutions. If the axle began at right angles to the track, this angle will not have been maintained and snaking will have begun.

Many bogies are in service with axleboxes having $\frac{1}{4}$ in. or more free longitudinal movement between the sliding surfaces. Under such conditions there cannot be any restraint against snaking of the wheels and the whole bogie is often affected with a similar motion. Little harm generally results until its timing coincides with the natural side oscillations of the bogie or body or both combined, in any one of which cases it can become violent and is then termed hunting.

Hunting is not only uncomfortable for the passenger and conducive to heavy wear of vehicle and track, but is a waste of locomotive power, for rattling a bogie sideways at this frequency demands several horse-power. Hydraulic dampers are often advocated as a remedy, but as already noted, any success they may have is not obtained without imposing some shocks on the body.

Measures against hunting

The best remedy is to throttle hunting at its source, using two lines of attack. First, the tendency of the bogie to snake can be greatly reduced by guiding both axles rigidly in the frame and so forcing them to remain parallel. To snake, one axle now has to carry the rest of the bogie with it and may actually be opposed by the other axle. The guiding system, for real effect, should not allow the axles to be more than 0·04 in. out of parallel, measured at their ends, when running. This is asking rather too much of the conventional axlebox slides, but is readily effected by other methods. It is also asking too much of the conventional plain-bearing axlebox; roller bearings are the only practicable means of keeping the axle close enough to its true position in the box. Indeed, therein lies the main advantage of the roller box: the other benefits claimed are not so clear-cut.

The second method of attacking hunting is to prevent the whole bogie frame from snaking by deliberately introducing friction to discourage it from rotating slightly about its pivot, for without this no snaking can occur. This friction is readily arranged by carrying part or all of the body weight on sidebearers as shown in Fig. 2b.

As this friction effect is transmitted to the rest of the bogie via the bolster, the importance of a rigid connection between the two will be appreciated, bearing in mind that an exceedingly small amount of bogie rotation may allow snaking to begin. As already stated, rubber-bushed links are admirable for the purpose, though care should be taken to choose types of sufficient stiffness. Of necessity, the sidebearers also must be rigidly positioned; the frequent practice of mounting them on a rubber pad may allow enough longitudinal movement to sabotage the whole principle.

Clearance in bolster slides

It is clear that the conventional bolster slides with their relatively large clearances cannot be expected to hold the bogie tightly enough to discourage snaking, no matter how great the sidebearer friction effect.

The degree to which the bogie is made difficult to rotate must be kept to the minimum needed to strangle snaking, or excessive flange wear will occur. Some increase when entering or leaving curves is inevitable, but should be greatly outweighed by the saving at other times. In any case, such wear can be kept to a minimum by arranging for the sidebearer friction to be low when the tyres are newly profiled (and have a small snaking tendency) and by letting the sidebearer friction rise in step with tyre wear and the increasing tendency to snake. This rising friction is easily arranged by designing the sidebearers to be greased once only each time the tyres are newly profiled; the decreasing effectiveness of the grease makes the bogie progressively more difficult to rotate as the months go by.

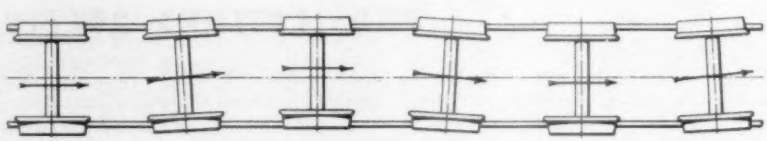


Fig. 6.—Snaking action of a wheel-pair, exaggerated

Combating flange wear

Bad lateral riding can also be combated by reducing the effects of wear on the tyres. The coned portions become hollow and increase the tendency to erratic lateral motion. A tyre profile like that shown in Fig. 7a will degenerate prematurely into the hollow form because the rail top is contacted near the centre only. Concrete evidence of this undesirably small load-carrying width is seen in the narrow, brighter strip on most rails and the not-infrequent band of rust on

*Part I appeared in our January 6 issue

both tyres and rails in regions marked X.

An alteration to the tyre profile to close the gap between it and the rail would provide extra metal precisely where needed to reduce hollowness and/or give extra mileage. The French Railways tyre employs this principle and Fig. 7b shows that the initial gap is much smaller than that of Fig. 7a; a very small amount of wear of tyre and rail brings them into wide contact. That this in fact occurs is shown by the uniform brightness of the average French rail over most of its width, there being no narrow bright strip. The hollowness of a worn tyre is also reduced by the taper marked Y.

It may also be noted that the steep, straight slope of the French flange (marked Z in Fig. 7b) is greater safeguard against derailment caused by the flange climbing the rail under emergency conditions.

Importance of reduced weight

It is an axiom of all vehicle suspensions that the unsprung weight should be a minimum. Reduction of the weights of wheels and axles, though desirable, should not be achieved by decreasing the wheel diameter without assessing the consequent reduction in the mileage run between tyre re-profiling. The bogie frame should be considered as partly unsprung weight relative to the body, for under some track conditions the former's vertical movement may be two or three times the movement of the axle that causes it; a light frame under such conditions will disturb the body less than a heavy one.

Bearing in mind that weight reduction brings other considerable benefits in its train, it is reasonable to state that no main-line carriage bogie with 42-in. dia. wheels should weigh more than 5 tons complete at the outside.

Prompted by its use on modern tube rolling stock, an all-rubber suspension is often proposed for main-line work without appreciation of the widely different conditions. Insufficient longitudinal rigidity of some rubber springs means that the usual bolster guidance system cannot be eliminated, and they thus lose their main advantage. They are also bulkier and heavier than equivalent steel coil springs, cost more and have a shorter life. Rubber auxiliary springs are often used to connect laminated axlebox springs to the frame, but such an application is misguided because the vibrations can be transmitted directly through the axlebox slides.

Limited uses for rubber

Apart from the stops and bushes already mentioned, together with simple pads under the bolster springs to complete the layer between bogie and body, there appears to be little use for rubber in a bogie of the type described. Its wider application will probably have to await a design of completely new conception.

Noise and vibration in the body are often caused by items other than the bogies. The drawgear and vestibule connections, though frequently at fault, are relatively easily detected and cured, as are engine vibrations on diesel multiple-unit trains. Some vibrations, however, are very elusive and are only noticeable because the body structure never can be perfectly rigid. A slightly curled letter lying on an office desk sometimes flutters because the building is vibrated by passing traffic. The movement of the building is usually quite imperceptible but the letter magnifies it enormously. A carriage body can similarly magnify small bogie tremors which would otherwise pass unnoticed. Here the vibration expert comes into his own, a slight stiffening of the structure at the critical point being all that is required.

Design work demands the consideration of several aspects in addition to the purely functional. Inspection in service is helped considerably by positioning all items for easy visibility ; the bolster guide links, for example, should be outside the frame. There must be a clear conception of the procedure for the replacement or repair of worn parts ; lack of foresight in this respect will make a bogie needlessly costly to maintain. The methods of manufacture also have to be borne in mind during design, or needless cost will again result.

Few bogies ride badly when new. In the past this has resulted in many new designs, later found unsatisfactory, being built in large quantities on the strength of a premature assessment. Completion of the initial design should be followed by the construction of several prototypes for trials totalling several hundred thousand miles to ensure an adequately-developed and proved version for quantity production.

The first priority is to tune the adjustments of items until the best possible ride is obtained. The positioning of the bolster guide links may need slight alteration and the hydraulic dampers probably will need trials with several dozen different settings.

Slow-developing faults

The next stage is to prove that riding quality does not deteriorate between overhauls. This may require a few bogies running about 100,000 miles each ; the occasional slow-developing fault should also come to light.

Such trials should also be used for modifying the design for quantity production. Experience shows that once a newly-conceived piece of machinery has been brought to the state of really satisfactory performance, it can almost invariably be considerably simplified and

Continued on page 77

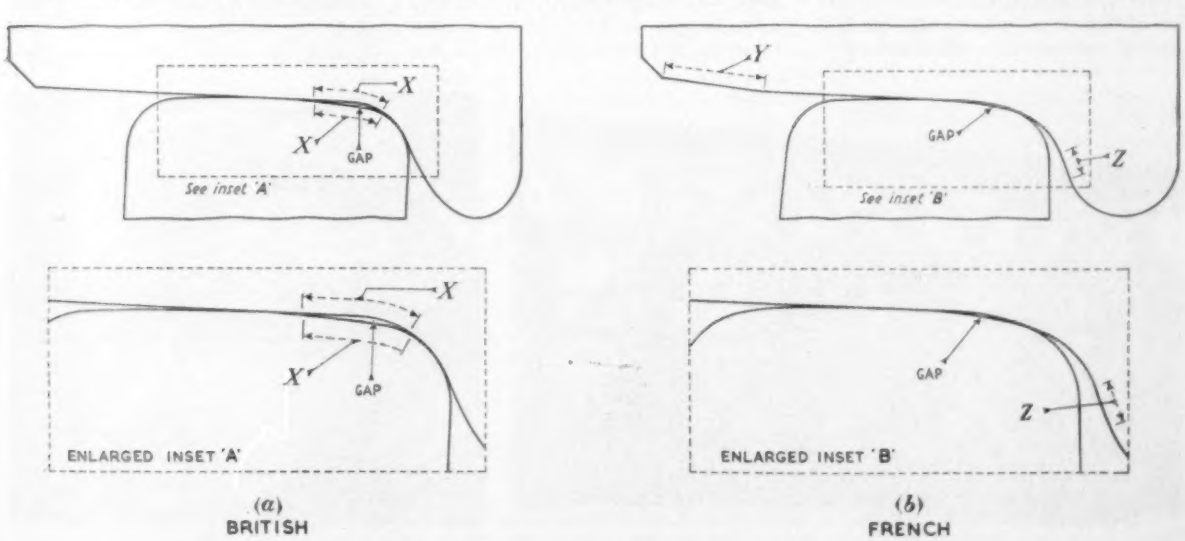


Fig. 7.—Unworn profiles showing comparison of gaps between tyre and rail with flange in action

St. Julians Bridge over the River Usk

STRENGTHENING ST. JULIANS USK RIVER BRIDGE

Removal of badly corroded and over-stressed diagonal web members, and renewal under traffic

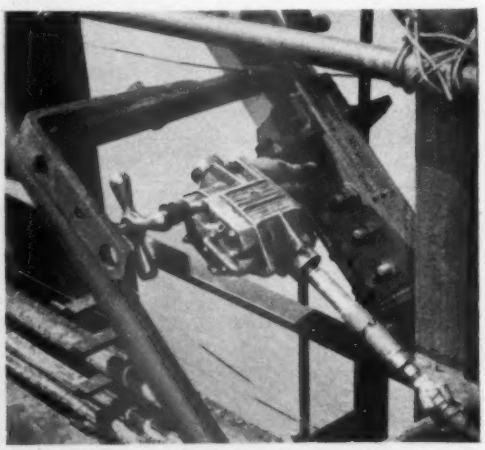
ST. JULIANS River Bridge carries British Railways, Western Region, Hereford-Newport line over the tidal waters of the River Usk. The two truss girders of each of the four 76-ft. half-through type wrought iron spans, built in 1872, have parallel chords, vertical end posts and a double N-system of web members. The chords have single flanges and two chord plates spaced only ¾ in. apart, the space between being filled with "iron" concrete. The diagonals consisting of one, two or three flats, pass through the verticals and were riveted to the chord plates. The 14 diagonals towards the middle of each girder, badly corroded and over-stressed, have now been renewed piecemeal under traffic.

To enable these members to be removed one by one, temporary diagonals carrying tensile loading only and consisting of a pair of solid mild-steel rods 2¼ in. in dia., 19 ft. 6 in. long and screwed at each end were fitted between steel crossheads strapped to and butting against the chord flanges.

Placing temporary diagonals

The inside steel rods were threaded through holes cut in the floor plating and in the webs of the cross girders. These temporary diagonals roughly paralleling the member being replaced were tightened with a single 25-ton Tangye Hydralite jack fitted with a screwed ram and a pressure gauge. Eight sets of temporary diagonals were used, but only one diagonal was renewed at a time in any one truss.

The tensile loading induced in and shared between the two rods of each temporary diagonal varied between 11 and 14 tons, according to the particular member under replacement. In a truss girder having two web systems and carrying a uniformly-distributed load, the final effect of removing and replacing a series of web members, one at a time, is the same as though it was the last diagonal only that had been renewed. Although at St. Julians temporary diagonals were used so that the work could continue under the passage of trains at restricted speed, the members were dealt with in a particular order. A start was made with those carrying the greater tensile shear loads



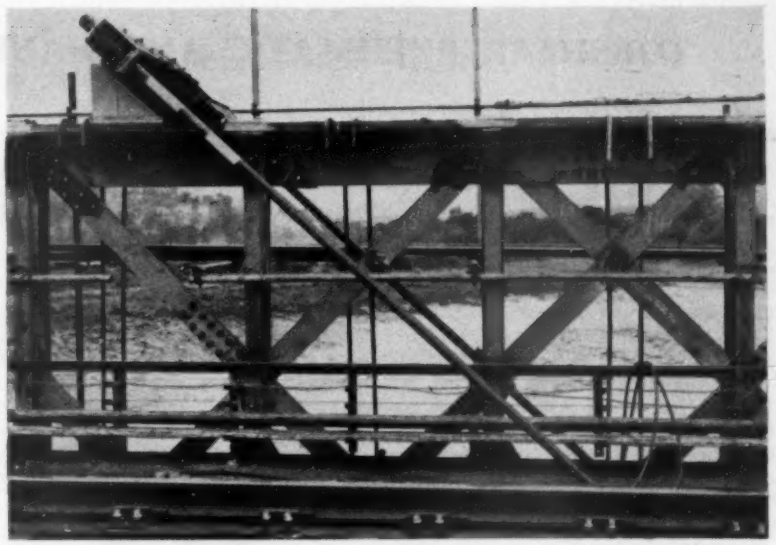
Left: some of the new diagonal web members and additional chord connections, and right, splicing holes being drilled in one of the new flat diagonals

and located nearer the ends of the truss and the work proceeded towards the centre of the span so that the last members to be dealt with in each web system were ones not ordinarily carrying tensile stress under dead load.

Two-piece diagonals

Each new permanent diagonal had to be made in two pieces because of the difficulty of threading the flats through the verticals and between the crossing diagonals. Also because it proved impossible to remove the concrete filling from between the chord plates, additional covers had to be used to complete the joints to the chords. The two pieces of each diagonal were pulled together with a pair of mild steel bolts $\frac{7}{8}$ in. dia. and $15\frac{1}{2}$ in. long connecting stout angle cleats bolted to each part. This device ensured an initial tensile load being induced in the parts of the diagonal before the holes were drilled and the butt straps were bolted up. All permanent connections have been made with high-strength bolts, Torshear being used wherever space permitted.

The strengthening scheme was devised in the Steelwork Office at Paddington. The new steelwork was supplied by the Fairfield Shipbuilding & Engineering Co. Ltd., and all the site work, including the fitting of new bracings between the cylinders of the piers, was carried out by railway labour under the direction of Mr. J. F. Bickerton, District Engineer, Newport.



Temporary diagonal in position

Obtaining a smooth running bogie—2

Concluded from page 75

cheapened without detriment to that performance. A bogie should be a rewarding object for such study, for not only is some overlapping of the functions of the essential features probable, but the large numbers likely to be built mean correspondingly big financial savings.

The initial design work should not take more than nine months and building of the prototypes another six months. Even with intensive running of several bogies, two years of trials may be needed before the design is finalised and quantity production can begin. It should be remembered that the bogie has been proved under certain types of carriage body only; similar results may not be given under bodies of widely differing weights and dimensions.

The whole of the foregoing applies to bogies for electric and diesel multiple-unit vehicles as well as locomotive-hauled stock. In fact, by reason of their present performance, bogies fitted with electric motors should show a bigger improvement than most types. If required to run over track which already shows heavy intermittent side wear caused by the snaking of existing stock, new bogies may show an increased tendency toward similar action and may need a counteracting rise in side bearer friction.

The benefits resulting from a large stock of vehicles equipped with such bogies should be considerable and not restricted to the passenger. Smooth running is synonymous with small wear ; the reduction in rolling stock maintenance cost should be appreciable. The track should also benefit, indeed a double saving is likely as the shock-absorbing qualities of the bogies should allow a small deliberate lowering of the standard of track maintenance without detriment to safety standards or the introduction of other disadvantages.

There is no reason why many existing bogie designs should not be modified to improve their performance, but in some cases it might be better to replace them completely. Though desirable and perfectly feasible from an engineering point of view, any policy of improving the riding qualities of existing rolling stock is likely to be decided mainly by commercial and financial considerations.

In conclusion it should be said that, while no design engineer would be rash enough to guarantee complete success by followed the principles described, particularly as he knows how poor detail design can spoil results, at least it is certain that without these principles no bogie, unless of widely different conception, can give more than a transiently good ride.

CAR SLEEPER SERVICE

The Eastern Region of British Railways again plans to run a motorcar sleeper service at week-ends between Sheffield and Exeter from May 13 to September 24, 1961. This facility, introduced in 1958, has proved to be of value to motorists in both the Sheffield area, and from further afield, for holidays in Devon and Cornwall.

Covered vans will be used for the transport of motorcars, with sleeping accommodation on the train for passengers. An inclusive fare for both driver and car of £15 10s. for the return journey will apply, and, for additional passengers, £4 10s. for adults and £2 10s. for children. If motorcar accommodation is available after the requirements of return passengers have been met, single bookings will be accepted at the following fares: car and driver £10 10s., additional passengers, adults £2 15s., children £1 10s. The train will depart from Sheffield Midland at 12.50 a.m. (Sunday) commencing May 14, and is due at Exeter St Davids 6.54 a.m., the same day. Motorcars can be loaded from 9.30 p.m. Saturday and passengers may also enter their accommodation on the train from that time. Breakfast can be arranged on arrival at Exeter if desired.

THE RAILWAY MUSEUM AT YORK

The year 1960 has been very successful for the Railway Museum at York, resulting in an increase of 10,232 visitors as against the previous year, and a total of 575,153 visitors since 1957 when statistics were first kept and a small charge was imposed. The publications on sale at the museum have proved to be most popular and sales have increased by 5,941 in 1960 on those of the previous year.

D

TORSHEAR PNEUMATIC AND HAND TOOLS

Design and operation of wrenches for automatic loading of high-tensile bolts on steelwork at site

FOR FIELD-WORK in bridge and other steelwork at least one Region of British Railways is finding the Torshear bolt an excellent aid conducive to both economy and efficiency. Many well-known bridge steelwork contractors also use it and the tools required to tension it, which were briefly described in an editorial and an article in our issue of October 21, 1960.

This application of the principle of Torshear has for the first time permitted the onus of accurately loading bolts to be transferred automatically from the operator—who has no control over it—to the bolt itself. In fact, each bolt insures its own tightness automatically and no subsequent inspection is necessary once the extension of the bolt has sheared.

The pneumatic wrench

The designs of both the hand and pneumatic Torshear wrenches are vital to the success of the Torshear principle. The pneumatic wrench in particular is extremely compact and effective, and is the result of years of experiment and improvement from time to time. Within a cylinder measuring only 15¼ in. long and 4¼ in. maximum dia. are a complete 3-h.p. reversible eccentric-vane air-motor running at 8,000 revs. a min. and a four-stage gearbox producing 1,000 lb. ft. at 10 revs. a min. Moreover it contains a gripping-head or chuck applying counter-clockwise torque to the extension of the bolt beyond the shearing groove, and also a nut socket-head applying clock-wise rotation, through differential gear, to the nut in the usual way. A balance of torque between the two is maintained until the increasing torsional stress on the bolt exceeds the calculated maximum torsional shear strength of the bolt at its minimum dia. at the groove. For dealing with less accessible bolts a 7-in. extension of the nose is available for various sizes of bolt.

Group of Torshear bolts being tightened with a pneumatic tool

Operation of tool

The operation of this power tool is simple and easily-grasped by an unskilled man. He has only to fit the appropriate-sized gripping-head and socket in the tool and to engage the nut with it. He then turns the knurled control-ring to the "on" position causing the chuck collet-pads to grip the bolt extension, the tool taking its own weight. The tool runs on until at the correct tension the extension shears; the sheared-off end of the bolt is ejected by reversing the control-ring.

The tool can be removed at any stage by reversing the motor, as is necessary when each bolt is bedded down in the preliminary stage of the tightening of the bolts. As explained in the previous article, it is essential to tighten them in two stages. The first involves a general tightening of a group of bolts to pull the plies together. This is done by letting the tool run on until the motor note is heard to change, it is then stopped and the tool transferred to the next bolt. After all the bolts in the group have been thus bedded, a final tightening and shearing of the bolt-extensions ensures a uniform bolt loading throughout the group.

The hand tool

Where comparatively few bolts have to be tightened, or where a compressor cannot be used, or in spaces too confined to permit of the use of the 15-in.-long power tool, the hand Torshear wrench is quite suitable. It measures only 6 in. in length (or 9 in. including the ratchet-lever arm attachment) and 4¼ in. in dia. The arm itself is 18 in. long and has a collapsible sliding extension handle, making it 24 in. if required. The mechanical action is similar to that of the power-wrench except that it is driven by a hand ratchet lever instead of an air-motor.

It is also placed on the bolt in the normal manner, taking its own weight when the bolt-extension is gripped with the collet-pads by turning a knurled knob counter-clockwise. The lever arm is then turned in the same direction, the knob being held on the reverse sweep against the ratchet until the end of the bolt shears off. All gripping-heads and nut-sockets are interchangeable with those of the power tool. For dealing with less-accessible bolts a 2½-in. or 2½-in. dia. extension up to 7 in. long is available in several bolt sizes.

The value of the Torshear system in making it unnecessary to hold the head of the bolt and enable all the bolt-tightening to be completed on one side of truss members or plates was shown at Dan-y-Graig bridge as described in our issue of October 21, 1960; and for the same reason there was no need to erect staging on the outside of the Wye Bridge at Boughrood, near Llyswen. In the construction of the Tamar suspension bridge, the bolting up of the external cover-plates of the end-to-end connection of the box-columns was made possible by Torshear bolting from the outside only.

Inspection simplified

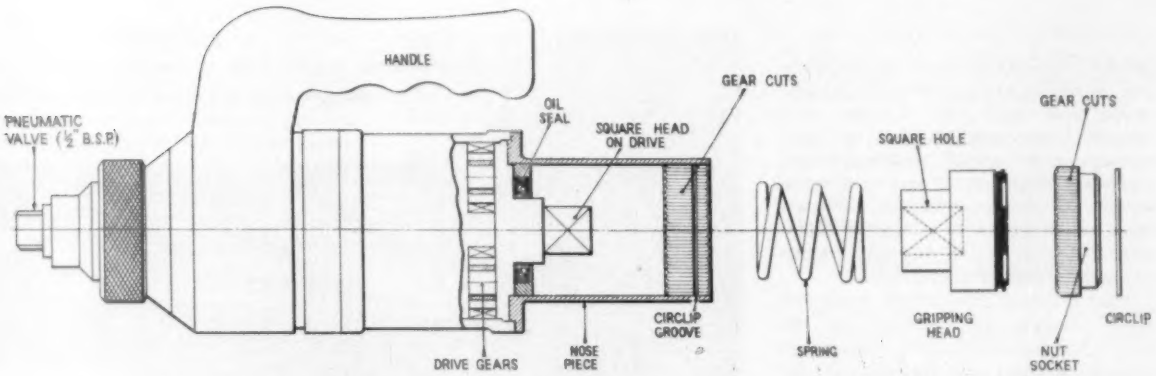
In inspection also the Torshear system has several advantages over an established impact method in the avoidance of any tool calibration; each bolt is its own calibrator, namely at the shear groove, and this is put under laboratory control at the makers' works. Moreover, never before could one guarantee that a bolt had not been used twice (this is heavily stressed in the new British Standard No. 3294), nor could one stand and look 30, 40 or 50 ft. up and say with certainty that the erectors had done a satisfactory job there. A bolt cannot be Torshear-tightened again after the extension has been sheared, and the only inspection necessary is to see the bright sheared ends.

To ensure that the bolts have been pre-tightened, inspection of the sheared ends normally reveals two sets of grip marks, showing that the tool has been applied twice to the bolt.

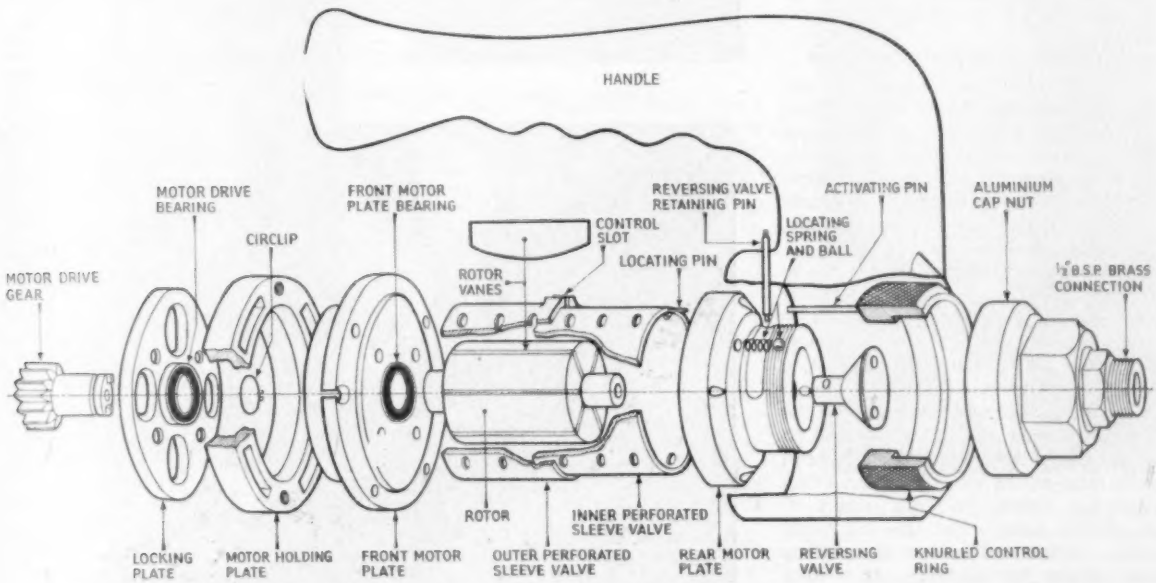
Much of the foregoing applies equally to the hand tool, which has its place on small contracts, or on service repair work. It has the advantage of a mechanically-geared tool to assist the torquing. With the bolts it is boxed as a complete kit, requiring no compressor, calibrator, or even an assistant operator.

The tools are manufactured by the North Bar Tool Co. Ltd. of Banbury.

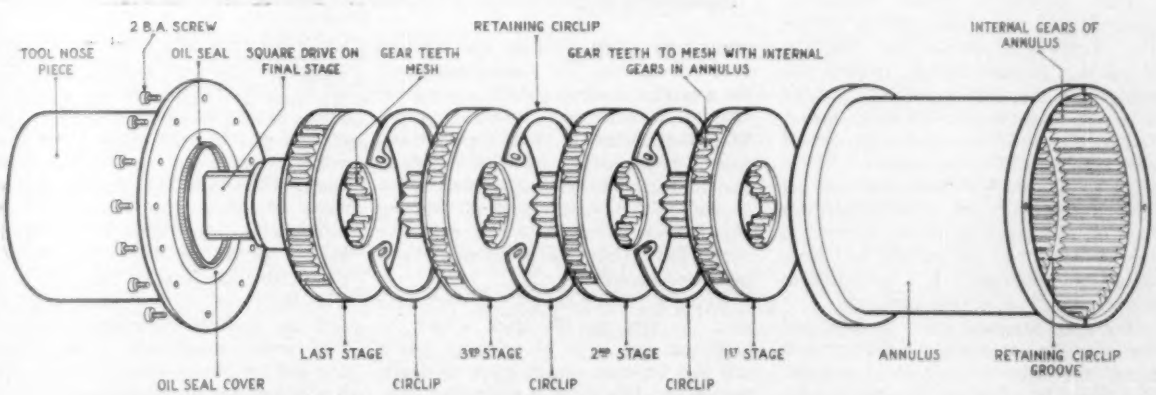
Torshear Pneumatic and Hand Tools



Layout of torshear gripping head and nut socket assembly in part section, for use with interchangeable tool parts



Air-motor assembly, showing details of parts from air-inlet (right) to drive gear pinion (left)



Details of gearbox assembly showing system of epicyclic reduction gears

Hardening Points and Crossings by Explosives

DESPITE the widespread use of manganese steel in crossing frogs and switch blades, serious and rapid wear in these parts remains a constant problem on most railways. As a result of consultation with explosives scientists it was considered feasible to produce adequate blows on this form of steel with the aid of explosives to harden it, but not with normal commercial explosives.

After extensive experiments, trials and many failures, the scientists on the North American Continent produced an explosive in sheet form that could be cut to the length and shape of the particular bearing surfaces of the steel that required the greatest hardening. Furthermore, they found an adhesive to secure the explosive sheet to the steel.

Advantages of explosive hardening

Last October the results of their investigations were finally tried out and demonstrated practically on manganese steel point and crossing parts. So successful and economical did this new hardening system prove to be that it is already being adopted by several major railways.

Among the advantages of this explosives hardening system are that it can be carried out in the open near the turnouts and requires no heavy plants such as those required for pressing or rolling. Moreover, unlike hardening by pressing or rolling which can be applied only to relatively flat surfaces, hardening by the new flexible explosive can be directed on to surfaces of almost any shape, namely, those most-rapidly wearing and becoming deformed during the early stages of installation under traffic. The hardening effect concentrated on specific wearing surfaces also has the advantage of deep penetration into the metal.

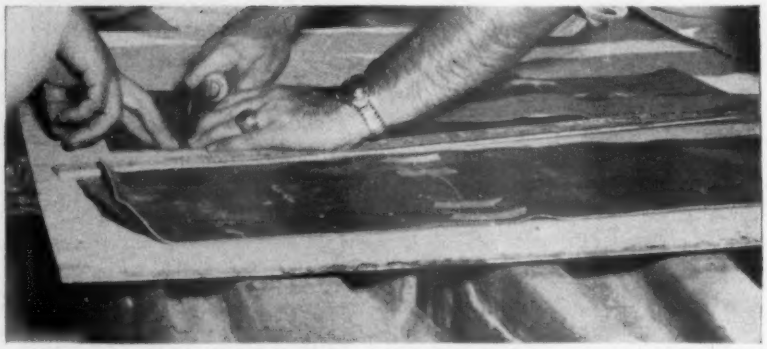
Sheet explosive

The particular sheet explosive developed in the United States by the Du Pont Foundation is basically P.E.T.N., Pentaerythritol Tetranitrate, but it also contains ingredients making it pliable. It looks like linoleum, is easy to cut into any shape, and is waterproof and highly resistant to impact. But it must be handled with great care and cut with a lino-knife or other implement only on a wooden or similar surface, as sparks developed by cutting on metal would be disastrous. It is produced in thicknesses of $\frac{1}{16}$ in. and upwards.

The sheet explosive is cut to shape and size according to a paper pattern traced from the surface to be hardened. The metal has first to be cleaned with acetone or similar cleanser and allowed to dry completely. The shaped portion of the explosive is cemented flat against the area to be hardened. To ensure a uniform impact over the entire surface being treated no air-bubbles must be allowed to remain trapped between the metal and the explosive. A special type of blasting cap is then attached to the explosive with adhesive tape and is detonated by a blasting machine.

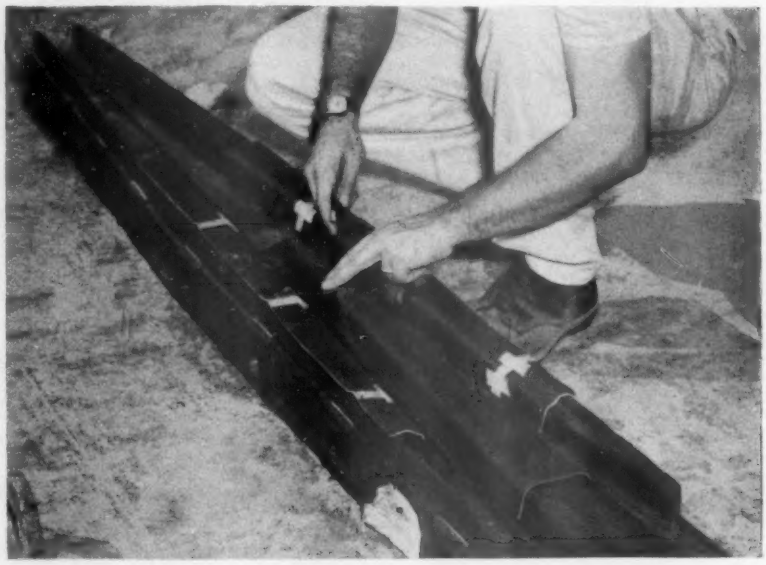
Firing is usually done in an open field near the spot on the track where the hardened part is to be installed, but it can also be done under water to muffle the report. The sheet is detonated from a safe distance and a shock wave flashing across the rail-part exerts pressures of up to 2,000,000 lb. per sq. in. on the steel. Molecules within the rail are thus compressed by the tremendous force exerted, setting up strain lines within them. These deformation lines interlock some of the atoms, preventing movement along "slip-planes" thus hardening the metal. The degree and depth of added hardness depends upon the shape and thickness of the sheet explosive and the number of impacts delivered. The correct attachment of the blasting cap and the observation of proper safety precautions are all-important.

Sheet-form explosive material which can be cut to shape and applied to rail surface



Above: Explosive sheet being cut to shape from a paper pattern

Below: Strips of explosive sheet being applied to surface of rail

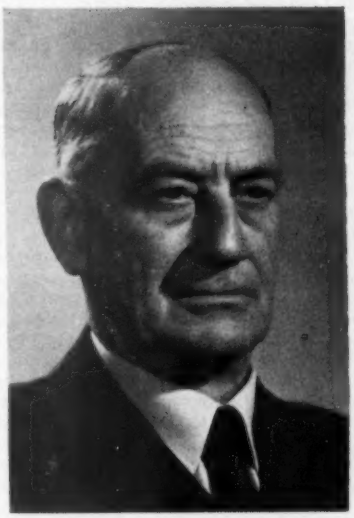


PERSONAL

Overseas

SIR JAMES FARQUHARSON, K.B.E., B.SC. (GLASGOW), M.I.C.E., General Manager, East African Railways & Harbours, who, as reported in our issue of December 23, has been appointed Engineer-in-Chief in the Office of the Crown Agents for Oversea Governments & Administrations, attended the Royal Technical College, Glasgow, graduated B.Sc. at Glasgow University and obtained a diploma of the Royal Technical College in 1923. From then, until 1925, he was Junior Assistant Engineer in the Western District, Lowland Division, Glasgow, L.M.S.R. In 1925 he was appointed Assistant Engineer, Kenya & Uganda Railways, and later became Senior Assistant Engineer.

In 1937 he was appointed Personal Assistant to the General Manager, Tanganyika Government Railways, and, in 1941, became Chief Engineer. From June, 1941, to August, 1942, on a part-time, and from August, 1942, to November, 1945, on a full-time basis, he was seconded for work in the operation of wartime controls in Tanganyika. In 1945 he was made General Manager of the Tanganyika Government Railways. From May 1, 1948, the undertakings of the Kenya & Uganda Railways & Harbours and the Tanganyika Railways & Port Services were amalgamated to form the East African Railways & Harbours, of which he at first became Acting Deputy General Manager, and in 1949 became Chief Engineer and Deputy General Manager. He was appointed General Manager of the Sudan Railways, in 1952, and took up his duties as General Manager, East African Railways & Harbours, in October, 1957. Sir James Farquharson was awarded the O.B.E. in 1944, the C.B.E. in 1948, and the K.B.E. last year.



SIR REGINALD TAYLOR, KT., C.M.G., B.SC. (ENG.), A.M.I.C.E., Engineer-in-Chief, Crown Agents for Oversea Governments & Administrations, who, as reported in our December 23 issue, is to retire in April, was born at Dunkerque, France, in 1895. He was educated at St. Lawrence College, Ramsgate, and University College, London. He was appointed an assistant engineer in the Public Works Department, Uganda, in 1920, became a senior assistant engineer in 1929, and an executive engineer the following year. In 1938 he was transferred to Nigeria as Senior Executive Engineer and, in 1945, was appointed Deputy Director of Public Works, Nigeria, becoming Director in 1947. In 1951 he became Director of Public Works, Kenya. His present appointment as Engineer-in-Chief with the Crown Agents dates from 1954. Sir Reginald is also Engineering Adviser to the Secretary of State for the Colonies.

Canadian National Railways has announced the following appointments:—

Regional Vice-Presidents

MR. D. N. GONDER, Atlantic Region, with headquarters at Moncton.

MR. W. H. KYLE, St. Lawrence Region, headquarters Montreal.

MR. E. WYNNE, Great Lakes Region, headquarters Toronto.

MR. J. R. MCMILLAN, Prairie Region, headquarters Winnipeg.

MR. R. GRAHAM, Mountain Region, headquarters Edmonton.

Regional General Managers

MR. J. W. DEMCOE, Atlantic Region.

MR. J. A. MCDONALD, St. Lawrence Region.

MR. W. C. BOWRA, Great Lakes Region.

MR. E. J. COOKE, Prairie Region.

MR. W. D. MCPHERSON, Mountain Region.

Also announced is the appointment of MR. J. A. O. BOIVIN as Special Assistant to the Vice-President, St. Lawrence Region and MR. W. C. HYMUS, Special Assistant to the Vice-President of the Great Lakes Region.

MR. S. SMITH, District Traffic Manager, Wellington, New Zealand Railways, is to retire shortly. He will be succeeded by MR. J. O'BRIEN, Transportation Assistant.

MR. D. M. HOULT, District Traffic Manager, Dunedin, New Zealand Railways, is to retire in the near future. He will be succeeded by MR. J. P. RUSSELL, Chief Stationmaster, Rangiora.

British Railways

MR. W. BROWN, Regional Accountant Designate, British Railways, Eastern Region, who has been appointed Chief Accountant, London Midland Region, joined the Chief Accountant's Department of the former

London & North Eastern Railway in Manchester in 1923. He transferred to London, in 1929 and obtained an L.N.E.R. Accountancy Apprenticeship in 1937, the first year of the scheme. He was appointed Assistant Secretary of the L.N.E.R. Superannuation Fund on its inception in 1939. He joined the Royal Artillery in August, 1941, and subsequently transferred to the Royal Engineers, being demobilised in May, 1946, with the rank of Captain. He was appointed Assistant Works Accountant for the North Eastern Area of the L.N.E.R. in 1946, and, in 1948, he became Assistant Regional Accountant, Scottish Region. In 1948 he was appointed Senior Assistant to the Director of Accounts, British Transport Commission, and in December, 1950, became Assistant Regional Accountant, Eastern and North Eastern Regions. He was made responsible for the general supervision of the Eastern Region Economic Survey Office on its establishment on March 1, 1957. Mr. Brown is a Chartered Secretary and holds the Brunel Medal awarded by the London School of Economics. He was appointed to the position he now vacates in 1959.

MR. A. W. WOODBRIDGE, Chief Signal Engineer, British Railways Central Staff, British Transport Commission, has been redesignated Chief Signal & Telecommunications Engineer.

MR. J. S. DOWNES, Assistant District Motive Power Superintendent, Nine Elms, British Railways, Southern Region, has been appointed District Motive Power Superintendent, Exmouth Junction. He succeeds MR. A. W. JOHNSTON, who is retiring.

MR. W. D. G. RYAN, Assistant District Motive Power Superintendent, London Bridge, British Railways Southern Region, has been appointed District Motive Power Superintendent, Brighton.

MR. W. J. ELLABY, Relief Stationmaster, Wakefield District, British Railways, North Eastern Region, has been appointed Stationmaster, Bradford Exchange Station.

MR. G. F. NOAKES, Principal Stores Assistant, London Transport Executive, has been appointed an Officer of the London Transport Executive with the title of Stores Superintendent.

MR. E. DALTON, M.B.E., Assistant to the General Manager (General), York, British Railways, North Eastern Region, who, as recorded in our December 30 issue, has been appointed Assistant Commercial Officer, York, entered the service of the London & North Eastern Railway in 1925 at Cherry Burton Station. He served for some years at stations in the Hull and York districts, and later with the Hull & Netherlands Steamship Company. In 1934 he was appointed a Traffic Apprentice and on completion of his training was appointed Chief Passenger Trains Clerk, Glasgow District. During the 1939-45 war, while serving with No. 3 Docks Group, Royal Engineers, Mr. Dalton was mentioned in despatches. He was demobilised in 1945 with the rank of major and was awarded the M.B.E. In 1947 he became Head of General Section, Chief Regional Office, York, and in 1951 was seconded to the Nigerian Railways as a District Traffic Superintendent. Two years later he returned to the North Eastern Region as Yardmaster, Hull. He was appointed

Assistant District Operating Superintendent, Darlington in 1955, and Assistant to the General Manager (General) at York, in 1957, the position which he now vacates.

MR. T. G. EATO, District Commercial Officer, Ipswich, Eastern Region, British Railways, who has been appointed Commercial Assistant to the Line Traffic Manager (Great Eastern), Liverpool Street, joined the London & North Eastern Railway, in 1926, at Bulwell Forest. After a period at stations in the Sheffield District, Mr. Eato was transferred, in 1936, to the staff of the Goods Manager, Liverpool Street, on special inquiries and staff work. From 1942 to 1946 he served with the Royal Engineers (Movement Control) in North Africa and Italy, and was demobilised with the rank of Captain. In 1946 he became Chief Clerk in the District Mineral Agent's Office, Kings Cross, and in the following year was appointed Chief Staff Clerk to the London City Manager and the District Passenger Manager, Liverpool Street. He became Assistant (General) to the District Goods Superintendent (London City), in 1953, and was appointed Acting Assistant District Goods Manager (London City) in 1954. In 1955 Mr. Eato transferred to the position of Assistant District Commercial Superintendent (General), Hull, and

became District Commercial Officer, Ipswich, in 1958, the position which he now vacates.

MR. GEORGE SAMUEL LINDGREN, a railway clerk, who was Labour M.P. for Wellingborough from 1945 to 1959, is among the new life peers announced on Monday. He was Parliamentary Secretary, Ministry of National Insurance, 1945-46; Ministry of Civil Aviation, 1946-50; Ministry of Town & Country Planning, 1950-51, and Ministry of Local Government & Planning, 1951. Member of the Hertfordshire County Council, 1931-49, 1952-55, and since 1958.

MR. B. T. RANDALL, Assistant to Commercial Officer (Freight Rates & Charges), Liverpool Street, British Railways, Eastern Region, has retired. He is succeeded by MR. J. W. DICKINSON, Assistant Freight Officer (General) Traffic, British Transport Commission.

MR. KENNETH F. MASON, District Goods Manager, Warrington, British Railways, London Midland Region, who, as recorded in our December 2 issue, has been appointed District Traffic Superintendent, Chester, began his railway career with the former London Midland Scottish Railway at Hendon in 1934 and subsequently worked at various goods stations in the London area. He served in the Royal Fusiliers and the Norfolk Regiment during the 1939-45 war and on demobilisation returned to the office of the District Goods Manager, Broad Street, London. After training as a Traffic Apprentice he was appointed Goods Agent, Chorley, in 1949. He subsequently became Goods Agent at Deptford Wharf in 1953 and Plumstead in 1954. He was appointed Assistant District Goods Manager (Sales), at Manchester in 1955, and in March, 1958, he was promoted to be District Goods Manager at Warrington, the position he leaves for his new appointment.

MR. S. F. RINTOUL, Traffic Costing Officer, Costing Division, Finance Department, British Transport Commission, Glasgow, has been redesignated Principal Traffic Costing Officer, Glasgow.

DR. R. J. D. ABRAHAM, Medical Officer, British Railways, London Midland Region, Euston, was successful in the recent examination for the Diploma of Industrial Health of the Society of Apothecaries of London.

MR. J. BELLAMY, Assistant District Operating Superintendent, Manchester North, British Railways, London Midland Region who has been appointed District Operating Superintendent, Derby, began his railway career in 1937 at Spondon, and gained further experience at Attenborough and Nottingham. He was commissioned in the armed forces, in 1939, and reported missing, in 1942, but was later found to be a prisoner-of-war. Mr. Bellamy returned to the District Operating Superintendent's Office at Stoke-on-Trent, in 1946, and was appointed Traffic Apprentice, in 1947. On completion of his training, in 1949, he became Assistant Yard Master, Willesden. In 1954 he was appointed Assistant to the District Operating Superintendent,

Nottingham, and two years, later transferred to a similar position in Birmingham and was promoted to Assistant District Operating Superintendent. Mr. Bellamy was promoted Assistant District Operating Superintendent, Manchester North, in 1958, the position he now leaves for his new appointment.

MR. C. AYERS, M.B.E., Acting District Goods Superintendent, Leeds, British Railways, North Eastern Region, who, as recorded in our December 23 issue, has been appointed District Goods Superintendent, Leeds, was educated at the Queen Elizabeth Grammar School, Wakefield. He began his railway career with the former London & North Eastern Railway in October, 1928, and was subsequently appointed a Traffic Apprentice. On completion of his training he was appointed Assistant in the Goods Manager's Rates Office, York. In 1938 he became Chief Research Clerk, Freight Development Section, Goods Manager's Office, York. During the 1939-45 war he served as a Lt.-Colonel in the Royal Engineers. He was awarded the M.B.E., and was twice mentioned in despatches. After the war he became Head of the Development & Special Travel Section, District Passenger Manager's Office, York, and, in 1947, was appointed Passenger & Parcels Agent, York. A year later he was appointed Head of the Canvassing & Development Section (Passenger), Commercial Superintendent's Office, York, and, in 1955, became Sales Assistant to the Chief Commercial Manager there. A year later he was appointed Passenger Assistant to the Chief Commercial Manager at York, and became Assistant Commercial Officer, Scottish Region, Glasgow, in February, 1960. He returned to the North Eastern Region in August as Acting District Goods Superintendent, Leeds.

MR. W. CLEGG, District Goods Superintendent, Leeds, North Eastern Region, British Railways, who has been appointed to the position of Traffic Manager (Tyne & Wear), Newcastle, began his railway service with the London & North Eastern Railway at Manchester in 1928. After experience in various departments, he was appointed a Traffic Apprentice in 1937, and, on completion of his training, held positions in the Commercial and Operating Departments. In 1947, he was appointed Assistant to District Superintendent, York, and, in 1949, became Stationmaster, Leicester Central, in 1951, Assistant District Traffic Superintendent, Ayr, and, in 1953, Assistant District Goods Manager, Newcastle-on-Tyne. He was later appointed Assistant District Goods manager (Sales), Newcastle, in the new sales organisation. He was appointed to the position he now vacates in 1957.

MR. W. O. J. WILLMOTT, Stationmaster, Cannon Street, British Railways, Southern Region, who, as recorded in our December 9 issue, has been appointed Stationmaster at Charing Cross, began his railway career as a clerk in February, 1935. After serving in a clerical capacity at various stations he was appointed Stationmaster at Herne Bay in August, 1951, and two years later he became Stationmaster at Walton-on-Thames. From October, 1954, to May, 1956, Mr. Willmott was Assistant Stationmaster at Waterloo, after which he became Head of Rules Section at the District Traffic Superintendent's Office, Woking. He returned to Waterloo as Senior Assistant Stationmaster in January, 1957, and on May 25, 1959, he was appointed Stationmaster at Cannon Street.

MR. D. WHELAN, Assistant to the District Operating Superintendent, Liverpool, British Railways, London Midland Region, has been appointed Assistant District Operating Superintendent, Derby.

Ministry of Transport

Transport Users' Consultative Committee. Yorkshire Area

The following have been appointed members of the Transport Users' Consultative Committee for the Yorkshire Area until November 30, 1963:—

Chairman

GENERAL SIR ROY BUCHER.

Members

MR. J. ILLINGWORTH and MR. J. MARSHALL, representing agriculture; MR. K. CAMPBELL-CULLEN, MR. W. D. ALLEN, MR. C. WOODHOUSE, MR. W. J. PRICE, MR. R. MCKIE and MR. H. BRADLEY, representing commerce and industry; MR. W. BARR, representing shipping; MR. F. ROBINSON and MR. J. A. PEEL, representing labour; CO. COUNCILLOR N. BISBY, CO. COUNCILLOR A. PICKERSGILL, COUNCILLOR F. MCHUGH, ALDERMAN J. RAFFERTY AND ALDERMAN G. A. BROWN, representing local authorities; MR. F. C. MARGETTS and MR. T. S. ROBERTS, representing the British Transport Commission.

Additional Members

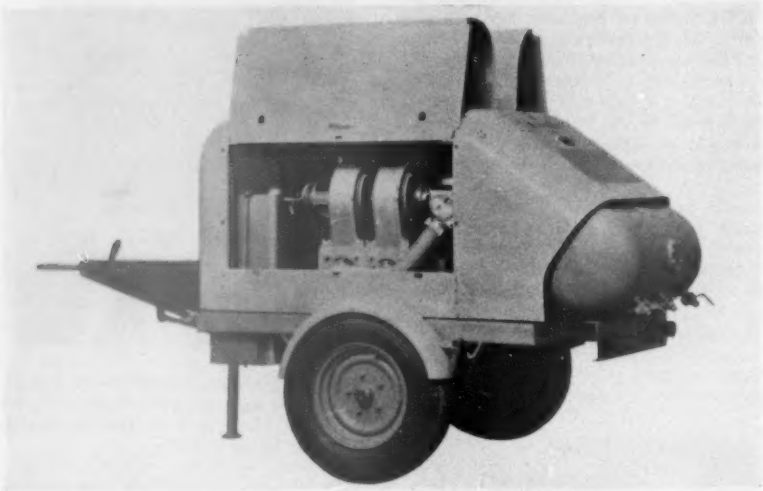
MRS. K. JACKMAN and VISCOUNT DOWNE.

MR. H. U. GINNS, Deputy Chief Road Engineer, Scotland has been appointed Divisional Road Engineer, North Eastern Division, Ministry of Transport, in the place of the late MR. J. G. TAYLOR. He is succeeded, in Scotland, by MR. R. A. H. ALLEN.

Ministry of Labour

We regret to record the death at the age of 69 of SIR GODFREY INCE, former Permanent Secretary to the Ministry of Labour.

NEW EQUIPMENT *and Processes*



PORTABLE COMPRESSORS

Jenbach JW440KF portable diesel-driven compressors, which are available in both air- and water-cooled versions, have the engine and compressor combined to form one integral unit whereby power is transmitted direct to the compressor by means of main and ancillary connecting rods. The diesel engine is of the four-stroke type.

The suction/delivery valves in the cylinder head of the compressor operate automatically. Concentric location of the delivery valve around the suction valve provides a dual cooling effect: internally due to the fresh air and externally due to the water jacket or air cooling. The compressed air leaving the high-pressure cylinder under a pressure of 100 lb. sq. in. passes through an annular radiator before reaching the receiver at moderate temperature. A centrifugal blower fixed to the flywheel provides the necessary air current.

The air chamber, having a capacity of 5.2 cu. ft. is welded and hydraulically tested for leaks. It is fitted with a safety valve set for 112 lb. per sq. in. working pressure, three cocks, and a drain cock for condensed water. The unit is started by means of electrical equipment comprising starter, preliminary heater, dynamo, regulator, and a heavy-duty battery. There is a fuel tank of 9 gal. capacity. The exhaust pipe includes a silencer.

The unit, with all accessories, including tools, is installed in a sprung-single-axle frame with pneumatic tyres. The chassis frame consists of a rigid welded structure. The steel-sheet covering with large side flaps is designed to offer reliable protection against the weather. The flaps may be locked to prevent unauthorised interference. The drawbar with standard hitching eye is detachable and an adjustable tow bar is provided, also overrun brake, hand brake, brake stop light, and lighting equipment for the number plate. The net weight is about 1 ton 5 cwt. 2 qtr.

Further details may be obtained from the distributor, Chamberlain Plant Limited, Crown Works, Southbury Road, Enfield, Middlesex.

SPOT-WELD REMOVER

The Pickavant JWP.318 spot-weld remover set, illustrated on the right, is designed to remove spot welds from steel plates, and can be used with a standard ¼-in. or ⅜-in. electric drill. It is claimed that the tool will remove a spot weld from the upper surface without causing damage or distortion to the joining part.

The process consists of two operations, for each of which a specially-designed cutter is used. The first-operation cutter has a hardened pilot point, which is applied to the centre of the weld to locate the cutter. A circular groove round the weld is cut, adjustment being provided on the cutter for the depth of cut so that the lower surface is untouched. This operation separates the plates.

The second-operation cutter is located in the circular groove and removes the remaining core of the weld. To prevent the cutter over-heating, a coolant, such as suds oil, should be used. The five operation stages are shown diagrammatically below.

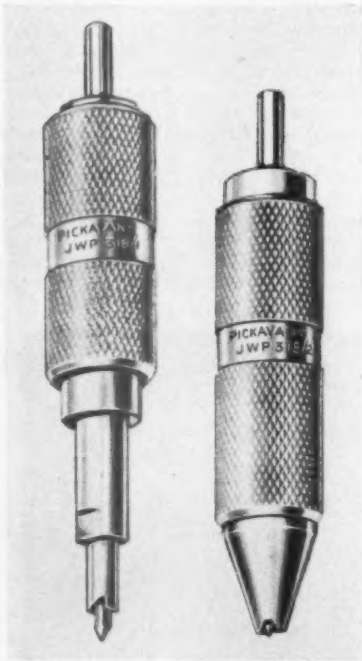
The cutters are of high-grade tool steel, and are quickly detachable. It is claimed that the use of this tool results in a considerable saving of time and labour.

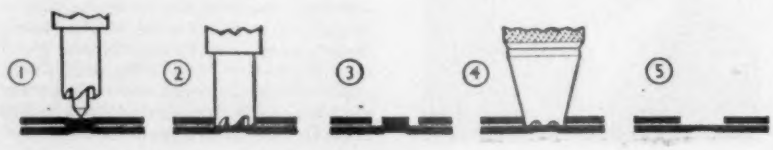
Further details may be obtained from J. W. Pickavant & Co. Ltd., Bow Street, Birmingham.

JOINTING COMPOUND

Autochemic 990 is a specially formulated paste compound developed to give high-strength corrosion-resistant joints on virtually all types of aluminium and aluminium alloys. It requires no finishing or after treatment and no filler alloy is required. The compound is merely painted on where required, facilitating preplacement on multiple or production joining applications, and giving great economy in use.

This material is recommended by the



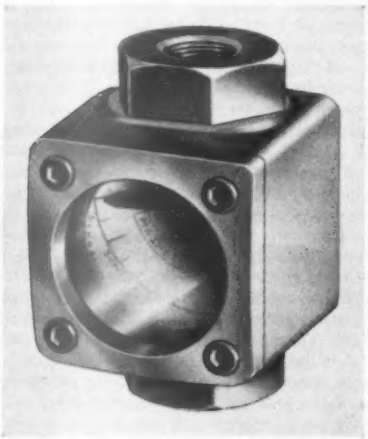


manufacturer for all fine work such as wire and cable joining, instrument parts, cans, small wave guides, floats, and other small fabrications. A neat fillet easily cleaned in warm water is produced by applying the compound and heating indirectly. A series of chain-type reactions take place terminating in metallic reduction at the reaction temperature of 400 deg. C. An extensive range of over 150 specialised Eutectic low-temperature welding alloys and fluxes can be joined by this means.

Further details may be obtained from Eutectic Welding Alloys Co. Ltd., North Feltham Trading Estate, Faggs Road, Feltham, Middx.

FLOW INDICATOR

The Bailey Magnetel indicator has been introduced to enable the flow of an opaque liquid through a pipe-line to be observed. It is suitable for use with liquids of almost any viscosity, such as thick oils, and can indicate flow either horizontally or vertically upwards.



The flow of a liquid through the main chamber of the instrument moves a hinged metal flap incorporating a magnet. This magnet actuates a pointer against a scale, both of which are encased in a separate chamber fitted with an observation window. The fluid is thus prevented from obscuring the scale. As there are no springs or other moving parts, the risk of mechanical breakdown or jamming is claimed to be largely eliminated.

The internal parts of the instrument are accessible for cleaning without having to remove the body from the pipe-line, and they can be turned through 90 deg., if required, if the direction of flow is changed.

Particular features of the instrument include its adaptability for extremely low rates of flow, and its sensitivity to small changes in relative flow. For situations where liquids contain ferrous particles a special version of the instrument is available, in which the magnet is enclosed in an intermediate chamber to prevent the particles from adhering to it. A further type has been introduced incorporating an alarm switch to give audible warning of loss of flow.

The instrument is available in ½-in., ¾-in., 1-in., and 1½-in. standard sizes with B.S.P.T. screwed ends, and with adaptors to match ⅜ in. and 1¼ in. The 2-in. size has flanged ends.

Further details may be obtained from Sir W. H. Bailey & Co. Ltd., Albion Works, Patricroft, Manchester.

TRAIN-HEATING BOILER

The range of Clayton steam generators for the heating of diesel-hauled trains has been extended to cover evaporative capacities of 430 to 2,500 lb. per hr. as shown in the accompanying table.

This design of oil-fired boiler, which is fully automatic in operation, is a self-contained unit mounted, with all auxiliary equipment, on a light fabricated-steel base. Steam is generated in a single continuous heating coil surrounding the combustion chamber, the working pressure being attained within five min. of starting from cold. A thermal efficiency of 80 per cent is claimed on full load and 75 per cent on light load.

The water in circuit is pump-circulated and, to ensure that the steam coil remains wet at all times, the volume in circulation is 30–50 per cent greater than the maximum rate of evaporation. The raw feed water is fed into an accumulator fitted with automatic level-control switches.

The top half of the accumulator has a centrifugal separator through which the steam passes before discharge to the train pipe. This reduces the moisture content of the steam to less than one per cent, the moisture removed dropping to the base of the chamber. Soft precipitation of salts resulting from chemical treatment of the feed-water is largely deposited in the accumulator, to which an automatic blow-down valve is fitted to prevent an excessive concentration.

Steaming rate is automatically controlled according to the demand, the modulating controls applied to the oil burner and to the forced-draught blower giving an automatic turn-down between full load and 25 per cent load. Ignition is by duplicated high-tension transformers which give a continuous spark if the burners are extinguished or on low fire.

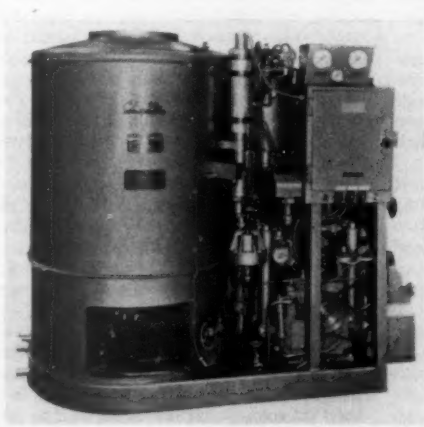
The pumps and air blower are driven by a d.c. electric motor, a small rotary converter being used to provide an a.c. current supply for the ignition transformers and the combustion and water-level controls. The complete equipment is fully protected against excessive pressure, high temperature of the steam coil, low water level, and flame failure.

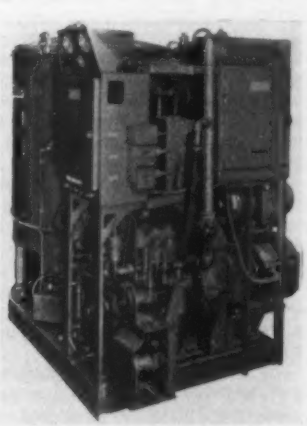
The accompanying illustrations are of the largest size of boiler, the RO.2500, that on the right showing the compact grouping of auxiliary equipment. The rotary converter is tier-mounted above the main motor.

The boilers are made under licence from the patentees, the Clayton Manufacturing Company, California, by the Vulcan Foundry Limited, Newton-le-Willows, Lancashire.

LEADING PARTICULARS OF CLAYTON TRAIN-HEATING BOILERS

Boiler Size	RO. 2500	RO. 1500	RO. 1000	RO. 500
Steam output lb. per hr. (kg. per hr.)	2,500 (1,135)	1,500 (680)	1,000 (455)	430 (195)
Heat output B.T.U. (kg. cal. per hr.)	2,912,500 (733,950)	1,673,750 (421,775)	1,158,235 (291,875)	502,125 (126,535)
Operating pressure lb. per sq. in. (kg. per cm.²)	65–115 (4.57–8.08)	65–115 (4.57–8.08)	65–115 (4.57–8.08)	65–115 (4.57–8.08)
Fuel consumption g.p.h. (litres per hr.)	22 (100)	13 (59)	9 (41)	4 (18)
Water content gal. (litres)	33 (150)	21 (95)	12 (54)	6 (27)
Heating surface sq. ft. (sq. m.)	150 (13.94)	115 (10.68)	76.43 (7.1)	49 (4.55)
Boiler weight, full cwt. (kg.)	38 (1,930)	21 (1,070)	15 (760)	10½ (530)
Length in. (mm.)	76 (1,930)	60 (1,524)	51 (1,295)	44 (1,118)
Height in. (mm.)	68 (1,753)	76 (1,930)	64 (1,626)	64 (1,626)
Width in. (mm.)	51 (1,295)	40 (1,016)	35 (889)	33 (840)
Electric motor h.p.	5	3	1.5	0.5





Ministry of Transport Accident Report

Interim report on the accidents which occurred on December 13 & 17, 1960, in Glasgow suburban electric trains, British Railways, Scottish Region

Brigadier C. A. Langley, Chief Inspecting Officer, Ministry of Transport, has issued an interim report on his inquiry into the accidents which occurred on December 13 and 17, 1960, in multiple-unit trains on the Glasgow electric suburban service. This service is operated on the dual high voltage a.c. overhead system, using 25 kV. 50 cycles single-phase a.c. on the outlying lines, but owing to the restricted clearances of the tunnels and bridges in the inner suburban area, it uses 6·25 kV. on this inner area. A neutral section divides each 25 kV. line from the adjoining 6·25 kV. line, and the change-over is carried out automatically.

In view of the public concern over the withdrawal of the electric trains after the second of these accidents, Brigadier Langley considered it his duty to report as soon as possible the results of the investigations which have led to the establishment of the primary cause of these failures, which was the faulty design of the train transformers, and to announce the action which is being taken to get the electric services restarted. These are the subjects of this interim report. All factors affecting these accidents and all other matters relevant to them will be dealt with in Brigadier Langley's full report, to be presented at a later date.

Other equipment troubles

Brigadier Langley said that he could not investigate the cause of these two accidents without taking into account the other transformer failures which have occurred on the Glasgow suburban system, and also other equipment troubles which may have had a bearing on these failures. Furthermore, as the investigation proceeded, it became essential to check the design of the transformers in use in trains on other sections of British Railways electrified on the high-voltage a.c. system. It further became necessary to take note of the failures which have occurred on these sections, to ascertain whether they and the Scottish Region transformer failures were in any way inter-related, and in particular whether the introduction for the first time on any railway of a dual high-voltage a.c. system had any bearing on the problem.

The Glasgow multiple-unit trains are made up of three-car units, comprising a driving trailer at the ends with a motor coach in the middle. The power equipment is carried below the floor of the coach, but the low-tension switchgear and some other auxiliary equipment is in a closed compartment between the guard's van and the passenger compartment.

The current collected by the pantograph from the overhead contact wire passes to the transformer which is mounted between the main members of the underframe in the centre of the vehicle. The transformer, which weighs about 4 tons, has a rating of 970 kVA and is designed to take current through the primary winding either at 25 kV. or 6·25 kV. The current from the secondary winding is taken to four single-anode pumpless air-cooled mercury-arc rectifiers, with a continuous rating of 700 kW. at 1,950 V. d.c. output.

Each pair of traction motors is fed through an iron-cored smoothing choke which is designed to limit this a.c. ripple in the d.c. motor current to 30 per cent at the continuous rating. The two chokes for the four motors are mounted together in a tank on the underframe, and are cooled by the same cooling system as the main transformer. The 210 h.p. motors operate on a rectified supply of 975 V. with a current of 165 A. with full field and 180 A. with weak field.

The auxiliary equipment includes the oil pump and radiator fan for the transformer oil-cooling system and the rectifier fans, all working directly off the tertiary a.c. supply, also the main and auxiliary air compressors, operated by d.c. motors supplied through an independent rectifier from the tertiary a.c. winding.

Transformer construction

The primary winding of the transformer comprises a cylindrical coil wound in four sections. They are connected in series for 25 kV. and in parallel for 6·25 kV. An electro-pneumatic change-over switch of the " off-load " type is mounted in an oil-filled chamber at one end of the transformer. This vessel does not form part of the oil circulating system but is vented to the conservator tank through the same pipe that vents the transformer cooling oil.

The secondary winding is laid in four layers of coils, one on top of the other, with appropriate oil passages round the central laminated steel core. It has seven intermediate tappings, of which one is the mid-point; all are designed to carry full load.

The tertiary winding comprises two coils in series, one at each end of the primary winding.

Oil cooling system

The transformer is encased in a fabricated steel tank mounted horizontally with the cover plate at the bottom. It is immersed in oil which is circulated at a rate of 50 gal. per min. The oil circulating system also embraces the tank containing the smoothing chokes. The oil pump sucks oil from the choke tank and forces it into the top of the transformer tank. After passing through this last tank the oil is drawn through the air-cooled radiator to the choke tank. Thus there is a negative pressure, amounting to a maximum of 6 lb. p.s.c. in the choke tank ; and a positive pressure, rising to a maximum of 3 lb. p.s.c. in the transformer tank.

The oil conservator tank is in the equipment compartment in the guard's van, and is connected to the top of the transformer tank by a ½-in. dia. pipe. Its function is to keep the transformer full of oil, and to take up variations in oil level due to variations in temperature, which may range from 0 deg. C. or even lower in winter to 95 deg. C. when the oil is heated to its maximum permissible temperature in summer. Originally the tank was vented to atmosphere through a silica-gel breather, but this arrangement was changed after the first transformer failure.

The auxiliary equipment compartment is at the passenger saloon end of the guard's van. As well as housing the conservator tank, it contains the low-tension cupboard and also the auxiliary compressor and certain compressed air equipment.

Protective devices include those intended to ensure the adequate cooling of the transformer and associated equipment, a thermostat which guards against over-heating of the cooling oil and a low oil-level relay. Both the last two cut off power by opening the air blast circuit breaker.

Transformer failures

(1) *Unit* 003. October 30, during a full-scale rehearsal of the new services due to open on November 7. An explosion occurred in the equipment compartment. Its cause was traced to a mixture of oil vapour and air having become ignited, probably by a spark from a contactor in the l.t. cupboard.

It was found that the secondary winding of the transformer had seriously overheated and that as a result the circulating oil had vaporised and entered the conservator tank whence it was not able to escape quickly. Consequently the pressure built up until the cover lifted slightly and allowed the vapour to enter the equipment chamber.

It was later found that a ½-in. vent pipe from the conservator tank was restricted to ¼-in. dia. in the silica-gel breather. To rectify this, the breather was by - passed and a 1-in. dia. vent pipe fitted to a plug-hole at the top of the tank. However, the contractor who carried out this alteration connected this 1-in. pipe to the existing ½-in. pipe through the floor, thus reducing the size of the vent exit.

(2) *Unit* 042. November 14. The driver experienced loss of power. There was no explosion, but the transformer tank was found to have bulged, and the secondary winding was found to be badly overheated. It was considered that the larger vent in the conservator tank had functioned effectively, allowing the oil gases to escape safely, thus preventing an explosion.

(3) *Unit* 051. December 13. An explosion occurred near Renton, injuring the guard and seven passengers. It was clear in this case that the enlarged vent was not big enough to allow the oil gases to escape. As a result holes were cut in the roof and floor of all equipment compartments, and a $\frac{3}{16}$-in. washer was inserted in the pipe leading from the transformer to the conservator tank, to restrict the flow of gas should another transformer overheat. It was thought that these alterations would prevent effectively the formation of an explosive mixture of oil vapour and air in the equipment compartment, thereby removing all danger to the passenger compartment and guard's van,

but it was realised that the possibility of a transformer overheating still existed.

Unit 031. December 14. Volumes of smoke were seen coming from the transformer. Subsequently the transformer tank was found to be bulged and oil leaking from it. The enlarged vent had been fitted, but the other modifications were to have been put in that night. Here again the vent had allowed the oil vapour to escape before an explosive mixture could build up in the equipment compartment.

Unit 014. December 17. The cover of the transformer burst open and was found to be hanging down close to the track. The modifications already described had prevented an explosion in the guard's van, but the pressure in the transformer had built up so rapidly that the cover bolts had sheared off before the gas could escape through the vent pipe. The possible danger of damage to carriage equipment and track was such that it was decided early the next morning to withdraw all electric trains from public service. Brigadier Langley was consulted beforehand and entirely agreed.

Independent investigation

From October 30, the date of the first failure, onwards, frequent meetings were held between representatives of the Scottish Region, the British Transport Commission and the manufacturers. At a meeting held on December 18, Brigadier Langley discussed with the B.T.C. officers the desirability of appointing a consulting engineer to make an independent investigation, and they decided to ask Mr. F. J. Lane, a partner of Messrs. Preece, Cardew & Rider, to undertake this work.

During all this time attention was concentrated on the oil cooling system, and various tests were made and proposals put forward. It was felt that the cause of overheating lay in this direction.

But on December 21, the transformer from unit 031, which had failed on December 14, was stripped down in the presence of Brigadier Langley, Mr. Lane and others. The primary winding was found to be in good order, and when it was lifted the wrappings covering the secondary winding were found to be undamaged. On removing them it was seen that the outer coil No. 4 of the secondary winding was distorted, but there were no signs of the insulation burning, and some oil was still noticeable. But a hole was found in coil No. 3 extending back to the core. Coil No. 2 was badly burnt, especially near the middle. In coil No. 1 a larger area had fused, and some of the turns below it were distorted and some were burnt. The distortion was similar to that of the secondary windings of other damaged transformers, but not so severe.

Electric, not thermal, failure

The absence of general overheating and the localised burning of the coils provided evidence for the first time that the thermal theory could probably be discounted, and that the failure was due to a breakdown of the winding insulation.

On December 22, two more transformers (from units 030 and 049) were reported to be "suspect." On being stripped down, it was seen that the secondary coils of Unit 030 showed serious displacement of the turns and over-riding in 10 places, and also distortion, but none of these inner coils showed any sign of over-heating. This transformer was clearly in the early stages of secondary winding failure. It was clear that it had been subjected to severe electro-magnetic forces, and the lack of any sign of overheating still further discounted the theory that failure of the oil circulation was a primary cause. In fact, in this case the thermostat had operated before the temperature of the oil had risen to a dangerous level.

Attention was therefore concentrated on the electrical rather than the thermal problem. At a meeting between Mr. Lane, Mr. Broughall, Electrical Engineer (Development) B.T.C., and the manufacturers, it was agreed that the secondary windings were not strong enough to withstand the severe electro-magnetic forces to which they had been subjected. As Brigadier Langley will describe in his final report, there was a period when there were frequent rectifier backfires and some failures of the control gear, which would subject the transformers to short-circuit conditions. It was considered that these conditions were sufficient to account for the displacement of windings by electro-magnetic forces.

It was agreed on January 1 that the transformers would have to be redesigned, and the manufacturer's representative made certain suggestions. Further investigations and tests were subsequently made.

Other regions

Meanwhile steps were taken to examine the various transformers in use in multiple-unit trains in other Regions. Mr. Lane concluded that there were such differences in the design and construction of these transformers and their associated equipment that there was no danger of a repetition of the Glasgow failures. Still he felt it would be desirable to arrange a further series of tests.

Notwithstanding that there had been only one failure in some 200 transformers of four other kinds in service, Mr. Broughall on his return from his visit to Glasgow on November 1, arranged a further investigation between the B.T.C. and the contractors' engineers of the oil-cooling and venting arrangements in all types of a.c. trains. By November 5 increased vents had been provided between the conservator and atmosphere in certain cases. After the Glasgow explosion of December 13, despite the fact that no further transformer failure had occurred in other Regions, orders were given for additional ventilation to be provided in the equipment compartments of the guards' vans for all a.c. trains. The question of removing the conservator from the guard's van is also being considered.

Inspecting officer's conclusions

Brigadier Langley points out that all the preliminary investigations were based on the belief that severe and prolonged overheating was the primary cause of the transformer failures. The examination of transformer No. 031 on December 21 threw the first doubts on this theory, and the examination of transformer 030 showed how the insulation of the secondary winding could be broken down by the distortion of the outer coils and over-riding of the turns. Once the insulation broke down, severe arcing would occur, followed almost immediately by the "cracking" of the oil and the rapid build-up of gas pressure in the transformer tank. The distortion of the coils of the secondary winding of transformer 030 also indicated that they had been subjected to severe electro-magnetic forces, which they could not withstand.

Mr. Lane's report

Brigadier Langley incorporates in his conclusions an interim report made by Mr. Lane to the Chief Electrical Engineer of the British Transport Commission. Brigadier Langley accepts this report. In it, Mr. Lane says that the transformers supplied for the Glasgow electrification did not have secondary winding assemblies strong enough to support the conditions to which they have been subjected in service operation. It is well-known that transformers associated with mercury-arc réctifiers are liable to experience onerous current and voltage conditions, due principally to occasional back-fires in the rectifiers and to current chopping which gives rise to over-voltages. It is generally recognised that one important feature in the design of the transformer is the provision of extra strength in the winding structure to withstand the electro-magnetic forces of heavy current conditions.

Mr. Lane added that in the early stages of public service in Scotland, the rectifiers are reported to have suffered back-fires on numerous occasions, this being due to overheating caused by defective ventilating arrangements. Failure of control gear had also caused short circuits. The manufacturers, have agreed that these would account for the winding failures, and Mr. Lane accepts this. The ventilation difficulties had been corrected, and during the last weeks of service the rectifiers showed good performance. Yet it is accepted that the design of the secondary windings was inadequate to withstand the heavy currents which must be encountered occasionally in regular service.

Mr. Lane said that no evidence had been submitted to indicate that the failure of the transformers was due to any special conditions arising from the dual high-voltage a.c. system.

A modified transformer design has been accepted in principle, and details are now being prepared. Prototypes will be tested, and preparations for substituting them for existing units are actively in progress.

Mr. Lane examined the transformers in other Regions. He is satisfied that all these other designs are suitable to continue in service but, to remove any doubts, all types will be subjected to further tests when a suitable programme has been agreed.

Brigadier Langley agrees that the Glasgow transformers were well built of high-quality materials. They had passed all the tests laid down by the B.T.C. including the appropriate requirements of British Standards. An earlier passage in his report gives details of the trial running of the units concerned and also their service running up to the time of failure.

Still Brigadier Langley agrees that the transformers' secondary windings were not strong enough. He says that the transformer as re-designed will be made up of a series of "pancake" coils of primary and secondary windings, interspersed in suitably disposed groups. The turns in each secondary coil will also be stronger.

As Mr. Lane says, ventilation and control faults have been or are being put right. But

additional reactance will be included in the circuits to limit abnormal currents, with additional arrangements to limit the effect of voltage surges and to protect circuits fed from the tertiary winding. The modified transformer should be adequate, but it will be given a new series of adequate tests under Mr. Lane's direction. Meanwhile, all other modifications found necessary will be carried out.

All this will be a formidable task. Brigadier Langley explains the intensive arrangements for this. It is expected that trial running will begin during March. It is not possible at this stage to forecast when public services can be started, but it seems likely that the work will take a few months to complete.

Brigadier Langley is also examining the failures on the Eastern Region. Their cause, he says, has not yet been established, but several alternative and possible complementary theories are being investigated. Correcting measures are being developed simultaneously so that appropriate action can be taken as soon as the exact cause has been found. It is not possible at present to predict when these faults can be rectified.

Pioneer system

Brigadier Langley pays tribute to the co-operation he has had from all concerned, and adds that he is particularly indebted to Mr. Lane. In conclusion he says that one must appreciate that the B.T.C. were breaking fresh ground in the field of electric traction. They had pioneered the system of dual high-voltage a.c. electrification, which never before had been used on any railway. It was applied to multiple-unit trains running on intensive suburban services.

Difficulties were inevitable, but they were more serious than anticipated, and Brigadier Langley's final report will consider how far they might have been averted. Still he is confident that the lessons learned from the Scottish and Eastern Region failures will be applied, as necessary, to all electric traction equipment built in Great Britain to ensure that it will be as reliable, as efficient, as safe as any in the world.

Export drive by electrical manufacturers

The British Electrical & Allied Manufacturers' Association representing one of Britain's major exporting industries with exports totalling nearly £300 million a year, is taking the initiative in a big overseas drive. Following the successful Export Sales Conference for manufacturers of domestic electrical appliances last year, which was attended by the President of the Board of Trade, exports of electrical household goods have increased by 25 per cent to nearly £30 million in the 11 months up to November, 1960.

B.E.A.M.A. arranged a meeting in London last Tuesday representative of the whole industry, ranging from electric toasters to nuclear power stations, at which over 130 export managers and senior executives met in closed session to examine the export position critically amongst themselves and to discuss ways of possible co-operation including arrangements for joint selling, market research and exhibiting of complementary products. The aim was to bring a forceful, concerted effort to bear on the most competitive overseas markets.

This followed the clear lead given at the British Electrical Power Convention in June last when members of not only the manufacturing industry but also the electricity supply industry urged the necessity for co-operation in the promotion of electrical exports.

Export directory

Also B.E.A.M.A. is preparing an export directory with a circulation of over 15,000 copies to overseas buyers, and this will include a reference section in Russian in addition to four other foreign languages. This will provide a new up-to-the-minute guide to B.E.A.M.A. manufacturers of electrical and allied equipment and a description of their products. It is intended that this directory will become a standard reference book for buyers all over the world.

Next month B.E.A.M.A. is collaborating with the Board of Trade in the largest collective display of British domestic electrical appliances yet staged in Europe. This will be at the International Household Goods & Hardware Fair at Cologne, where the Association has secured three adjoining island sites in a prominent position near the main entrance to the Fair. A contingent of about 30 sales executives from the industry will lead this assault on the Continental market.

Associated Electrical Industries (Rugby) Limited in 1960

During 1960, Associated Electrical Industries (Rugby) Limited, continued to supply traction equipment to British Railways. The Southern Region electrified a further section of its Kent Coast line between Ramsgate and Dover on October 31 for running trial trains. A.E.I. high-speed circuit-breakers are installed in five substations and five track paralleling huts along this second section of the scheme to be put into service. For Phases 1 and 2 of the Kent Coast electrification scheme A.E.I. has already supplied 256 high-speed circuit-breakers, and upon completion of the scheme equipment for 25 substations and 27 track paralleling huts will have been supplied.

To the order of Tage Olsen, A.E.I. agent for Denmark, five type " RJR.712," 1,000-A. high-speed circuit-breakers are being supplied to replace existing equipment on the Copenhagen suburban railway system of the Danish State Railways.

Rectifier equipment

One of the most notable events of 1960 in the rectifier field was the inauguration of the 25-kV. a.c. electric train services between Manchester and Crewe. This project, together with the electrification of the Glasgow suburban lines and the conversion of the Eastern Region Shenfield line to a.c. operation, required a total of some 600 rectifier equipments installed in locomotives and motor coaches. Seventy-five per cent of the locomotives and more than 50 per cent of the motor coaches will be equipped with A.E.I. rectifiers, approximately two-thirds of them semi-conductor type and the remainder single and multi-anode mercury-arc.

The first automatic power control gear for the Glasgow Suburban Railways has been developed and commissioning completed by Electronic Apparatus Division. The supply system is at 25 kV., dropping to 6·25 kV. under bridges. Resulting from successful trials on prototype voltage regulators for train lighting, 300 such regulators have now been ordered by the London Transport Executive. These regulators are of the magnetic type and will control the excitation of the alternators supplying the fluorescent lighting in coaches of L.T.E. Underground trains. Two types of inverter have also been developed for providing power for fluorescent lighting where the supply is direct-current. One uses two silicon controlled rectifiers and operates from 110V. d.c. supplying up to six 40-W. lamps. The other unit, which is smaller and employs two transistors, supplies one 40-W. or two 20-W. lamps from a 24-V. d.c. supply.

Speech communication

Speech communication between ground and moving vehicles has been supplied to British Railways for use on the 25-kV. a.c. traction system linking Colchester and Clacton. In addition to providing speech communication between a control point and locomotives, timing pulses can be transmitted from a master clock to the moving train. General development has been concerned with the simplification and standardisation of existing gearbox designs for traction applications.

North Eastern Region marshalling yards

Five large contracts recently placed by British Railways, North Eastern Region, cover the major part of the technical equipment to be installed in the new mechanised marshalling yards now taking shape at Newport near Middlesbrough.

The two largest contracts, awarded to, Westinghouse Brake & Signal Co. Ltd. are for signalling and control equipment inside the yard and on the main lines in the area. Under the first contract 30 miles of running lines in the area, now operated by four signalboxes, are to be remotely controlled from a switch console housed in one of the yards' two control towers. The console operator will be able to set 315 separate routes and control 106 signals and 131 power-driven points.

The second contract is for the signalling apparatus required for controlling shunting operations within the yards from the control towers. The switching of points for the wagons rolling from the humps into the various sidings will be governed by a push-button control panel allowing fully automatic operation.

Two further contracts have been awarded to British Insulated Callender's Cables Limited. One is for yard floodlighting, consisting of eleven 150-ft. lighting towers together with the equipping and commissioning of three major sub-stations. The other is for signalling cables; altogether 43 miles of multi-core cables and 16 miles of double-core power cables are to be installed. The remaining contract, awarded to the Tarmac Group, is for construction of the two control towers. Tenders have also been invited for cab signalling equipment for the yard locomotives and an associated inductive radio system.

CONTRACTS AND TENDERS

Permanent way material for Carlisle Marshalling Yard

The Eagre Construction Company has received a contract for the installation of some 56 miles of plain track in running lines and sidings together with the design, fabrication and installation of some 350 sets of switches and crossings at Carlisle Marshalling Yard, British Railways, London Midland Region. The contract, which is due to commence in the near future and is programmed for completion in 48 weeks, also involves the placing and mechanical tamping of limestone top ballast. Other features of the contract are the provision of 24 sets of switches and crossings in high-manganese steel, the installation of some 10 miles of plain track in pre-fabricated 60-ft. lengths and the electrical welding of 4,000 rail joints by the Phillips process. The total cost is in the region of £250,000.

The Isca Foundry Co. Ltd. has received an order for the supply of permanent way points and crossings for the Malayan State Railways. The value is some £37,000.

British Railways, Southern Region, has placed the following contracts:—

Aubrey Watson Limited: strengthening of Harbour Wall, Padstow

James Robb & Son Ltd.: cleaning and painting of viaduct, Shoreham-by-Sea

E. C. MacDermot & Company: new concrete roadway, Nine Elms

Caffin & Co. Ltd.: dismantling and removal of timber staging, Cannon Street River Bridge

Smith & Jewel Limited: new tubular steel gantries, extension of electrification, Ashford (Kent)

P. & M. Contractors Limited: renovations, Sevenoaks, Wateringbury, Beltring, and Branbridges Halt

R. Corben & Son Ltd.: new footbridge, extension of electrification between Folkestone and Dover Marine

Wm. F. Blay Limited: new staff accommodation, Swanley.

British Railways, North Eastern Region, has placed the following contracts:—

L. C. Abdale Limited: alterations to toilet accommodation at Middlesbrough Passenger Station

Wright Anderson & Co. Ltd.: roof drainage work at Shildon Wagon Repair Shops

Arthur Robinson (Contractors) Limited: earthworks at Newport Marshalling Yard

G. Brody & Co. Ltd.: supply and erection of roller shutter doors at Shildon Wagon Works Repair Shop

Derek Crouch (Contractors) Limited: provision and spreading of filling material at Lamesley new marshalling yard

Mitchell Construction Co. Ltd.: construction of three railway bridges over the River Calder and a bridge to carry Storrs Hill Road over Healey Mills new marshalling yard

Dowty Hydraulic Units Limited: supply and erection of a pilot installation of hydraulically operated retarders and booster retarders at Hull Inward Yard

Solus-Schall Limited: supply of ultrasonic axle testing equipment for the Chief Mechanical & Electrical Engineer's Department

Durham Steelwork Limited: supply of steelwork for Bridge No. 3 carrying the Tyne Dock Bottom Branch over Jarrow Road at South Shields

Acme Engineering Co. Ltd.: supply and erection of a conveyor system and six-ton feed hopper at the Central Concrete Depot, York

Arthur Heaton & Co. Ltd.: Liversedge for extension of existing heating system at Walkergate Carriage and Wagons Works

A. Robinson (Contractors) Limited: construction of a reinforced concrete bridge and associated earthworks for the new up yard hump at Newport Marshalling Yard.

The Export Services Branch, Board of Trade, has received calls for tenders as follow:—

From Portuguese East Africa :

11 third class railway coaches.

The issuing authority is the Ports, Railways & Transport Department, Lourenco Marques to whom bids should be sent. The tender No. is 27/61. A provisional deposit of Esc. 275,000 must be made by tenderers. Drawings and specifications are obtainable from the Railway Warehouse at Lourenco Marques through the local agents of United Kingdom firms interested. The closing date is March 29, 1961. No further information about this call for tenders is available at the Board of Trade. The Board of Trade reference is ESB/496/61.

From Iraq:

47,050 switch railway sleepers

4,550 bridge railway sleepers of various sizes.

The issuing authority is the Directorate-General, Iraqui Republican Railways, Ministry of Communications, Baghdad, to whom bids should be sent. The closing date is February 8, 1961. The Board of Trade reference is ESB/33870/60.

From Sudan:

1 heavy duty motor driven radial drilling machine.

The issuing authority is the Stores Department, Sudan Railways, to whom bids should be sent. The tender No. is 2303. The closing date is February 28, 1961. The Board of Trade reference is ESB/269/61. No further information is available at the Board of Trade.

Supply of 2 goods sheds for Port Sudan.

The issuing authority is the Stores Department, Sudan Railways, to whom bids should be sent. The tender No. is 2138. The closing date is January 26, 1961. The Board of Trade reference is ESB/34077/60. No further information is available at the Board of Trade.

150 *tonnes* of diesel crankcase lubricating oil.

The issuing authority is the Stores Department, Sudan Railways, Atbara, to whom bids should be sent. The tender No. is 2278. The closing date is January 31, 1961. The Board of Trade reference is ESB/264/61. No further information is available at the Board of Trade.

1 heavy-duty motor-driven single vertical boring and turning mill.

The issuing authority is the Stores Department, Sudan Railways, to whom bids should be sent. The tender No. is 2294. The closing date is February 13, 1961. The Board of Trade reference is ESB/34207/60. No further information is available at the Board of Trade.

1 horizontal three ram hydraulic pressure pump.

The issuing authority is the Stores Department, Sudan Railways, to whom bids should be sent. The tender No. is 2302. The closing date is February 27, 1961. The Board of Trade reference is ESB/268/61. No further information is available at the Board of Trade.

1 heavy-duty motor-driven slotting machine.

The issuing authority is the Stores Department, Sudan Railways, to whom bids should be sent. The tender No. is 2301. The closing date is February 16, 1961. The Board of Trade reference is ESB/267/61. No further information is available at the Board of Trade.

From India:

Supply, installation and maintenance of route relay inter-locking and train describer units at Howrah.

The issuing authority is the Eastern Railway. Tender documents with drawings and specifications are obtainable from the Chief Signal & Telecommunication Engineer, 17 Netaji Subhas Road, Calcutta. The tender No. is ER/HWH/R-Relay/111. The closing date is June 23, 1961. The Board of Trade reference is ESB/34182/60. No further information is available at the Board of Trade.

From Greece:

10 sheets, special steel, firebox plates, thickness 20 mm. and dim. 2 x 5 mm. and 20 pieces firebox tube plates, fabricated from special steel plates.

The issuing authority is the Purchasing & Stores Department, Hellenic State Railways, 34 Themistocleous Street, Athens, to whom bids should be sent. Local representation is essential. The tender No. is 4897. The closing date is January 31, 1961. The Board of Trade Reference is ESB/563/61.

Further details relating to the above tenders together with photo-copies of tender documents, unless otherwise stated, can be obtained from the Branch (Lacon House, Theobald's Road, W.C.1).

NOTES AND NEWS

Firth-Vickers Stainless Steels at engineering exhibition. The theme of the Firth-Vickers Stainless Steels Limited stand at the Engineering, Marine, Welding & Nuclear Energy exhibition at Olympia, London, next April will be technical collaboration between producer, fabricator, and designer. Since the development of stainless steel close collaboration has been maintained between Firth-Vickers and engineers and fabricators, but more recently the industrial designer has sought guidance in the use of special steels for particular applications. The stand will concentrate on welding techniques and will cover several methods of stainless steel welding. Products such as sheet, bar, strip castings and centrispinnings also will be shown.

Festiniog Railway in 1960. The year 1960 was the busiest for the Festiniog Railway since 1925, a total of 101,900 passenger journeys having been achieved. This compares with a figure of 76,000 for 1959. The Festiniog Railway Society has continued to give steady support to the railway throughout the year, both by voluntary labour and financial contributions. A special train is to be run as usual from Paddington to Portmadoc for the annual general meeting of the Society on April 22, 1961.

Collision blocks line. Two goods trains collided head on at Morris Cowley, near Oxford, on January 12. The engines were locked together and three wagons were derailed, blocking the line linking Oxford with Princes Risborough. No one was hurt.

Glyn Mills & Company final dividend. A final dividend of 8 per cent is proposed by the board of Glyn Mills & Company in respect of the year ended December 31, 1960. An interim dividend of 8 per cent was paid in July. Profit for the year was £403,730, against £399,484 for 1959.

Ministry of Transport move to Southwark. The Ministry of Transport is moving from Berkeley Square House to new Headquarters at St. Christopher House, Southwark Street, London, S.E.1, tel. Waterloo 7999. The Minister's office was transferred on January 9. From January 16 all communications for any part of the Ministry should be sent to the new address.

Associated Commercial Vehicles Limited. The authorised capital of Associated Commercial Vehicles Limited is to be increased from £3·8 million to £6 million by creation of £1 ordinary shares.

English Steel Corporation, Sheffield works. The telephone No. of the English Steel Corporation Limited, River Don, Grimesthorpe, Park, Stevenson Road, and Tinsley Park works has been changed to Sheffield 49071.

Alterations to B.T.C. Passenger Charges Scheme. The public inquiry into two applications by the B.T.C. for the alteration of the British Transport Commission Passenger Charges Scheme, 1959, under Section 79 of the Transport Act, 1947, will be held at the Niblett Hall, 3 (North), King's Bench Walk, Temple, London, E.C.4, on January 24, starting at 11 a.m.

Lifting barriers in the Scottish Region. The level crossing gates are to be replaced by lifting barriers at Blackford, where British Railways, Scottish Region, Glasgow-Perth main line crosses the Stirling-Perth trunk road. The road will be widened and straightened to provide a better approach for road traffic. When the new installation is introduced there will be double electrically-driven half lifting barriers on each side of the crossing.

Collision at level-crossing. On the evening of January 6, a steam engine drawing a train of six coaches between Maidenhead and High Wycombe collided with a motor van at Strand Castle level-crossing, British Railways, Western Region. There have been two other accidents at this crossing, which is of the accommodation type, in the last three years. The driver of the van was seriously injured and his companion, who had left the vehicle to open the crossing gates, was killed. The train passengers were taken to their destinations by motor coaches.

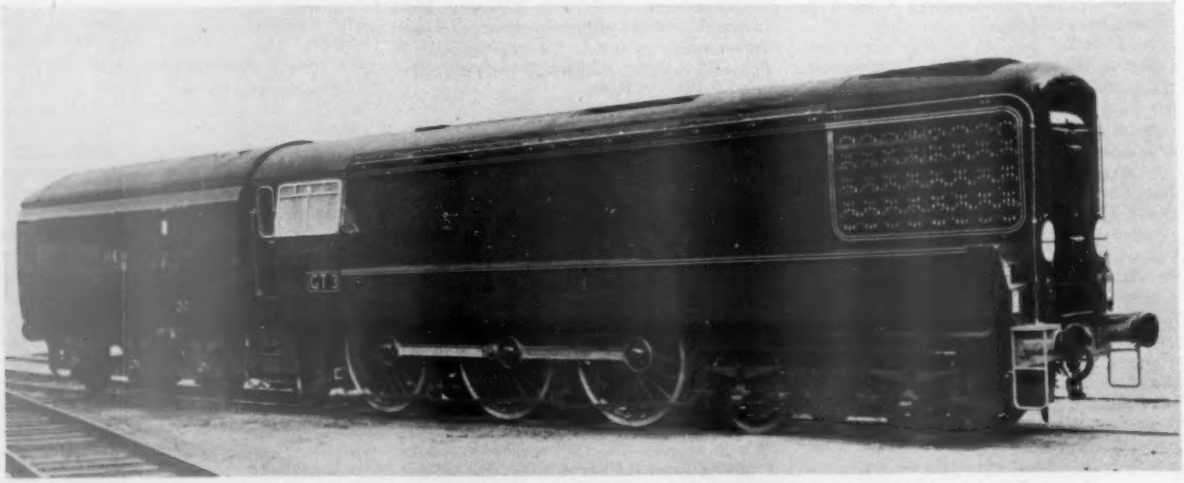
Killed in tunnel. On January 11 a mathematics student at Oxford was killed in a railway tunnel between Conway and Llanfairfechan. The decapitated body was found halfway through the tunnel.

L.T.E. "RW" buses move to Surrey. The three London Transport Executive experimental one-man-operated "RW" type buses, at present based at Hemel Hempstead garage, are to move to Addlestone garage this month for use on routes 427, 437 and 456. The 42-seater "RW" buses have A.E.C. Reliance chassis and Willowbrook bodywork with two doorways, that at the front for passengers boarding and that in the centre for passengers alighting. They first entered service in September, 1960, on routes 322 and 322A, between Watford and Hemel Hempstead.

Engineering work in the London Midland Region. The London Midland Region of British Railways has announced that because of heavy engineering work on the main line between Euston, Manchester, and Liverpool, the journey times of some services will have to be extended and some trains may arrive later at their destinations. The Trent Valley line between Rugby and Stafford will be closed on Sunday and trains will be diverted *via* Coventry, Stechford and Bescot. In addition, the line between Crewe, Warrington and Liverpool will be closed and trains diverted *via* Sandbach and Northwich or *via* Chester and Warrington.

Closure of Whitby West Cliff Station. British Railways, North Eastern Region, has announced that Whitby West Cliff Station is being closed on June 12, 1961. This measure has been approved by the Transport Users' Consultative Committee for the North East-

ENGLISH ELECTRIC GAS-TURBINE LOCOMOTIVE



Experimental gas-turbine locomotive "G.T.3" now on trial service with British Railways (see last week's issue)

ern Area, and the Central Transport Consultative Committee. Alternative facilities for passengers are provided by United Automobile Services Limited, which operates a frequent bus service to and from Whitby Town Station. Freight and parcels traffic will be collected and delivered by British Railways road motors based at Whitby Town Station. Freight traffic in full wagon loads, not requiring cartage by British Railways, will be dealt with at Whitby Town Station.

Kullen & Company U.K. representative. Details of the washing plant supplied by Kullen & Company, Reutlingen, Western Germany, at the South Gosforth Carriage Sheds, Newcastle upon Tyne, were given in our December 9, 1960, issue. Kullen & Company is represented in this country by The Welwyn Tool Co. Ltd., Stonehills House, Welwyn Garden City, Herts., tel.: Welwyn Garden 5403.

Oil explosion at Stratford. Eight hundred gallons of oil blasted into flames on January 12 in Thornton carriage sidings at Stratford in the Eastern Region of British Railways. Three men in a railway boiler house nearby escaped unhurt. Later, one of them said they went to replace a thermostat. "The boilerman came down to shut the boiler off and left. We shut the current off and got one wire connected. Then we heard a sudden hissing sound." After that, the hissing built up to a thundering noise. Just as the men got out of the building there was an explosion. The oil tank at the back of the boiler house was blown on its side and blazing oil was scattered over the coaches in the sidings.

Steel theme for African Trade Fair. "British Steel" will be the theme of the British Government exhibit at the Central African Trade Fair to be held at Bulawayo from May 3 to 14. The exhibit will be in nine sections dealing with steel for structures, power, mechanical engineering, transport, mining, oil, stainless steel, agriculture, and specialist purposes. A central display will illustrate some of the latest processes of drop forging, hot and cold rolling, electrolytic tinning, wire-drawing, and tube making.

Richard Thomas & Baldwins increased profits. The group profits of Richard Thomas & Baldwins Limited were increased by £4·6 million to £14·7 million in the year ended October 1, 1960. The total dividend is 13½ per cent. Output of steel is reported to have been unhampered by development difficulties as most of the more complex improvements to plant at the Ebbw Vale works had been completed by the end of the preceding year.

Symposium on foamed rubber and plastics. A one-day Symposium on foamed rubber and plastics is being arranged by the London Section of the Institution of the Rubber Industry, and the Plastics Institute. This will be held at the Institution of Electrical Engineers, London, on May 5, 1961. Full details will be announced at a later date.

Proposed merger of Gloucester Railway Carriage & Wagon Co. Ltd. and Winget Limited. General Sir William Morgan, Chairman of Gloucester Railway Carriage & Wagon Co. Ltd., and Mr. Robert Ducas, Chairman of Winget Limited, engineers, iron founders and machine builders, have announced that they are jointly considering a merger of the two companies. The terms are expected to be in line with recent market prices for the shares of the two companies.

Record iron and steel production by Colvilles. Production by the Colvilles group in 1960 was a record, for both steel and pig iron. Outputs exceeded those of 1957, the previous record year. Steel production was 2,158,700 tons last year, against 2,099,700 in 1957, and pig iron output 1,026,800 tons compared with the previous record of 876,300 tons.

Simms Motor Units Limited agreement with Bendix Corporation. Simms Motor Units Limited of London has granted to the Bendix Corporation of Detroit an exclusive manufacturing licence and selling rights throughout the United States for Simms diesel fuel-injection equipment. Non-exclusive selling rights have been granted for Canada, Mexico, and Brazil. The Bendix Corporation also assumes complete responsibility for servicing throughout the area. The Simms interests will be handled by the Scintilla Division at Sydney, New York State. The range of products involved includes fuel pumps, injectors, filters, and couplings, all of which are already being exported to America by Simms Motor Units Limited.

Expanding market for A.C.V. products. Prospects for 1961 of Associated Commercial Vehicles Limited are considered by the Chairman, Lord Brabazon of Tara, to be good, subject to there being no industrial upheaval. In his statement circulated with the report for the year ended September 30, 1960, he remarks that the results for the current year to date maintain an improvement. Production has responded well to the growing order book. Group profit, before tax, rose from £966,115 to £1,512,935, and the total 22½ per cent dividend is an effective increase of 5 per cent. The improvement in home market trading conditions has continued. Vigorous steps have been taken to increase overseas business. As a result of efforts to expand sales of diesel engines and units, turnover has been more than doubled. The "Routemaster" bus, developed in co-operation with L.T.E., is now entering service in London in increasing numbers.

Revised British Standard for oxy-acetylene welding of mild steel. The revised British Standard B.S.693: 1960, unlike its 1940 edition, is considered applicable to all forms of structures other than pressure vessels and pressure pipelines for which special standards exist. It sets out the requirements for the oxy-acetylene welding of general-purpose mild steel with a tensile strength not exceeding 33 tons per sq. in. and containing not more than 0·25 per cent carbon, 0·06 per cent sulphur and 0·06 per cent phosphorus. Requirements are laid down for butt welds, fillet welds, cleanliness of fusion faces and workmanship, with appropriate tests. There are appendices on distortion control, butt weld bend tests, fillet weld fracture tests and flame conditions and a suggested method of preparing etched specimens. Copies may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1, price 6s.

Electronic Computer Exhibition, London, 1961. "The Work of the New Generation of Computers" will be the theme of the Electronic Computer Exhibition to be held at Olympia, London, on October 3-12, 1961. Emphasis is likely to be placed as strongly on new applications as on new equipment. The Business Computer Symposium, to be held at Olympia on October 4-6, will enable users from some of the largest and smallest firms in Britain to speak of their experience with computers and to exchange information. An appeal is to be made to the businessman who is considering installation of electronic data processing equipment. Display boards will bear statements from directors of user companies stressing the value of computers to their businesses. Visitors will be able to arrange inspection of computer installations of particular interest to them. The exhibition and symposium are organised jointly by the Electronic Engineering Association and by the Office Appliance & Business Equipment Trade Association which also runs the Business Efficiency Exhibition running concurrently at Olympia. Some 40 exhibitors are divided almost equally between manufacturers of computers and firms concerned with ancillary equipment.

Firth Cleveland Group new offices. The Firth Cleveland Group has acquired the lease of 7 Cleveland Row, St. James's, London, S.W.1, adjacent to the Group headquarters at Stornoway House, Cleveland Row. Occupants of the new offices include the Home Sales Divisions of Firth Cleveland Instruments Limited and Surform (Firth Cleveland Tools Limited). The telephone no. is Whitehall 3100. Stornoway House accommodates, amongst others, all departments of Firth Cleveland Limited, Firth Cleveland Pumps Limited sales offices, the export sales offices of Firth Cleveland Instruments Limited, and the London sales office of the Firth Co. Ltd.

Dorman Long & Co. Ltd. record steel production. Most of the rolled steel products of Dorman Long & Co. Ltd. were in full demand in the year ended September 30, 1960. This is stated in the review of the Chairman, Sir Ellis Hunter. Steel outputs were raised at all works, and the new installations contributed on an increased scale. Smaller bridge building and engineering results were caused by reduced demand and lower margins on contracts. Greater demand for steel enabled Dorman Long (Steel) Limited to achieve more economical working resulting from near-capacity operation of plant. Exports of plain steel were a record. A new Dorman Long product to be marketed soon is non-corrosive, fire-resistant plastic-coated steels for cladding industrial buildings. Dorman Long (Bridge & Engineering) Limited has begun steel erection on the 800-ft. arch of the Rohri bridge over the Indus in Pakistan.

Thos. Firth & John Brown results. A final dividend of 7½ per cent, less tax, making 12½ per cent for the year, is recommended by the board of Thos. Firth & John Brown Limited for the 12 months ended September 30, 1960. The Chairman, Sir John Green, states that difficulties associated with the manufacture of heavy forgings and castings have increased, and competition for such business as is available is very keen. Until world demand for heavy capital equipment

revives, this side of the business will remain unremunerative. The demand for bars and billets and all forms of rolled products remains good. The business in hardened steel rolls and back-up rolls is determined by the demand for flat products. Forward orders are satisfactory. The demand for all types of stainless products remains high.

Withdrawal of passenger facilities. from Temple Hirst Station. British Railways, North Eastern Region, has announced that passenger train facilities at Temple Hirst Station, on the Selby-Doncaster main line, will be withdrawn, and the adjacent freight depot will be converted to a public delivery siding from March 6, 1961. Approval for these measures has been given by the Transport Users' Consultative Committee for the Yorkshire Area and the Central Transport Consultative Committee. Alternative facilities for passengers will be provided by the West Riding Automobile Co. Ltd. There will be no change in the present arrangements for dealing with parcels and small consignments of freight traffic requiring cartage by British Railways' road motors based at Selby. Freight traffic in full wagon loads will be dealt with at the public delivery siding.

Railway Stock Market

Stock markets opened the week with a downward swing because of a widespread tendency for buyers to "go slow" until there is further news of the Chancellor's special measures to help export trade and any further indications as to Budget policy. Although h.p. restrictions are expected to be eased shortly, there have been rumours in the City that Mr. Selwyn Lloyd may have in mind a capital gains tax and the extension of purchase tax.

Foreign railway stocks have been steady, but quotations were not tested by many dealings, which is not surprising in view of the general uncertainty prevailing in stock markets. Antofagasta ordinary stock has been steady at 16½, while the preference stock strengthened to 34¾; the 4 per cent perpetual debentures were 46½.

Chilean Northern 5 per cent first debentures were 53 xd, Costa Rica ordinary stock changed hands around 37½, while the first and second debentures were 96 xd and 113 respectively. Guayaquil & Quito assented bonds kept at 55½, Brazil Railway bonds were again quoted at 4¾, and in other directions, activity persisted in Paraguay Central prior debentures at around 17½. United of Havana second income stock remained at 6 and Sao Paulo Railway 3s. units were 10½d. International of Central America common shares and preferred stock were respectively $19½ and $100½.

Canadian Pacifics eased to $40 xd after an earlier small gain; the 4 per cent debentures were 60¾ and the 4 per cent preference stock 58½ xd. White Pass shares have been dealt in around $10.

Nyasaland Railways shares kept at 9s. with the 3½ per cent debentures 35½. Midland of Western Australia ordinary stock was marked 7 and the second debentures 26. Business at 110 was recorded in West of India Portuguese capital stock. Barsi Light Railway ordinary stock was quoted at 16.

Among shares of locomotive builders and engineers, main attention attached to Gloucester Wagon following official confirmation that the company is considering with Winget, the firm with which they have a working arrangement, ways in which a merger would be of mutual advantage. Gloucester Wagon 10s. shares moved lower on balance at 13s. 6d., profit-taking having followed an earlier advance. Winget's 5s. ordinary shares were also 13s. 6d. Wagon Repairs 5s. shares moved higher on balance at 20s., Beyer Peacock 5s. shares held steady at 6s. 1½d., but following the passing of the interim dividend, Charles Roberts 5s. shares fell back to 7s. Westinghouse Brake strengthened to 41s. 7½d. while G. D. Peters remained at 15s. 7½d. North British Loco were again 6s. and Birmingham Wagon shares showed dealings around 27s. 1½d.

In other directions, there was a rally in General Electric to 32s. 4½d. under the influence of the new chairman's statement of views on the position and outlook for the group. Associated Electrical were better, too, at 42s. 6d., and English Electric 33s. 9d., but later in the week, prices tended to react with the general trend in stock markets.

Pressed Steel 15s. shares were 26s. 3d., and Dowty Group 10s. shares 34s. 6d. In a more active machine tool section, Coventry Gauge 10s. shares were 23s. 10½d., Alfred Herbert 55s. 3d. and Craven Bros. 5s. shares 9s. 10½d. In other directions, Vickers have reacted to 28s. 9d. and Ruston & Hornsby to 27s. 3d. Leyland Motors were active up to 84s. 4½d., and Stone-Platt shares steady at 55s. 9d.

Forthcoming Meetings

January 24 (*Tue.*). The Institute of Transport, Metropolitan Graduate & Student Society, at 80, Portland Place, W.1, at 6.15 p.m. "Railway Rationalisation and modernisation with particular reference to the Great Northern Line," Mr. L. Lloyd.

January 24 (*Tue.*). The Institution of Railway Signal Engineers, Bristol Branch, at 6 p.m. "Panel Schemes and Relay Interlocking," Mr. J. S. Hawkes.

January 24 (*Tue.*). The Institution of Civil Engineers, at Great George Street, S.W.1, at 5.30 p.m. "The choice of protective schemes for structural steelwork," Mr. F. Fancutt and Mr. J. C. Hudson.

January 24 (*Tue.*). The Institution of Electrical Engineers, Measurement & Control Section, at Savoy Place, W.C.2, at 5.30 p.m. Discussion: "Machine Tool Control."

January 25 (*Wed.*). The Institution of Electrical Engineers, Electronics & Communications Section, at Savoy Place, W.C.2, at 5.30 p.m. "Generation and Amplification in the Millimetre Wave Field," Mr. W. E. Willshaw.

January 25 (*Wed.*). The Institute of Traffic Administration, Devon & Cornwall Branch, at S.W. Gas Board Theatre, Plymouth, at 7.15 p.m. "Problems of Distribution," Mr. N. R. Trehair.

January 25 (*Wed.*). The Royal Society of Arts, at John Adam Street, Adelphi, W.C.2, at 6 p.m. "Architecture in transport," Dr. Ing. F. F. C. Curtis.

January 25 (*Wed.*). British Institute of Management, at 80, Fetter Lane, E.C.4. "The selection and status of the foreman," Mr. D. W. Cole.

January 25 (*Wed.*). Peterborough Railway Discussion Group, at Peterborough Technical College, Eastfield Road, at 6.45 p.m. "Electronics and Transport," Mr. G. H. Hinds.

January 26 (*Thu.*). The Permanent Way Institution, Nottingham & Derby Section, at Derby, at 6.30 p.m. "Two-level baseplates and chairs," Mr. P. F. James.

January 27-29 (*Fri.-Sun.*). Railway Students' Association, Visit to Crewe-Manchester Electrification.

February 1 (*Wed.*). Peterborough Railway Discussion Group, at Peterborough Technical College, Eastfield Road, at 6.45 p.m. "Modernisation Progress in Eastern Region," Mr. H. R. Gomersall.

February 1 (*Wed.*). Electric Railway Society, at the Fred Tallant Hall, 153 Drummond Street, N.W.1, at 7.15 p.m. "Mountains and Railways of Central Switzerland," Mr. J. G. Bruce.

February 2 (*Thu.*). British Railways, London Midland Region, Lecture & Debating Society and Railway Students' Association, at Paddington, at 5.45 p.m. Debate: "That there is a wasteful use of national resources in the field of long distance freight traffic."

OFFICIAL NOTICES

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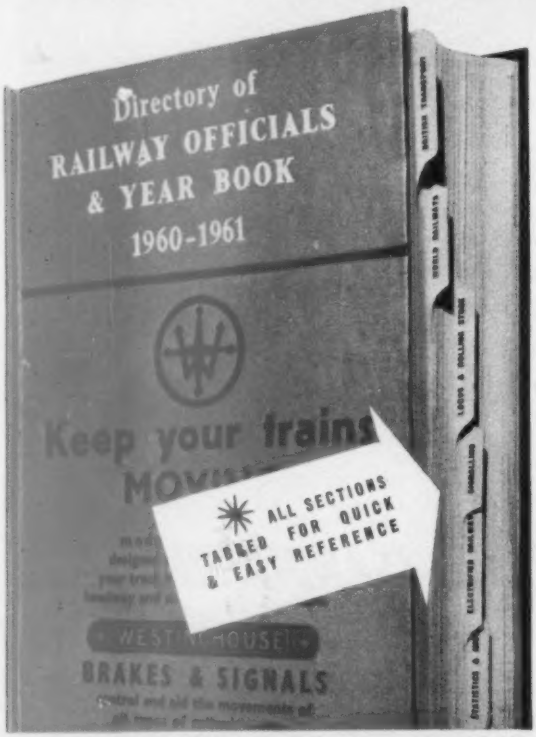

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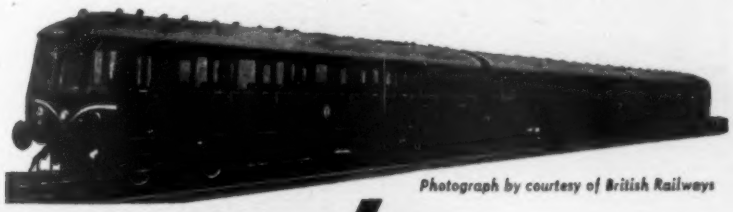

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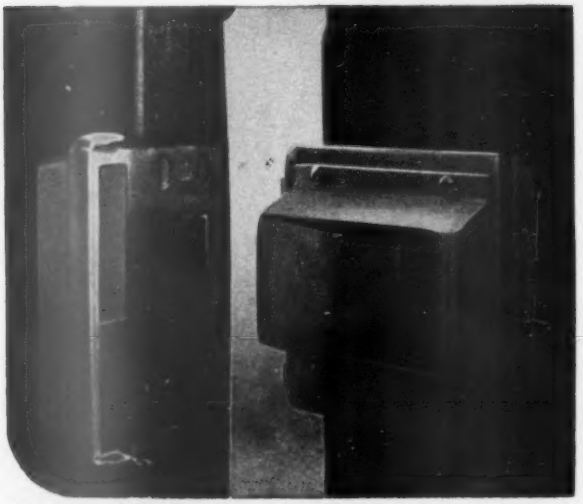

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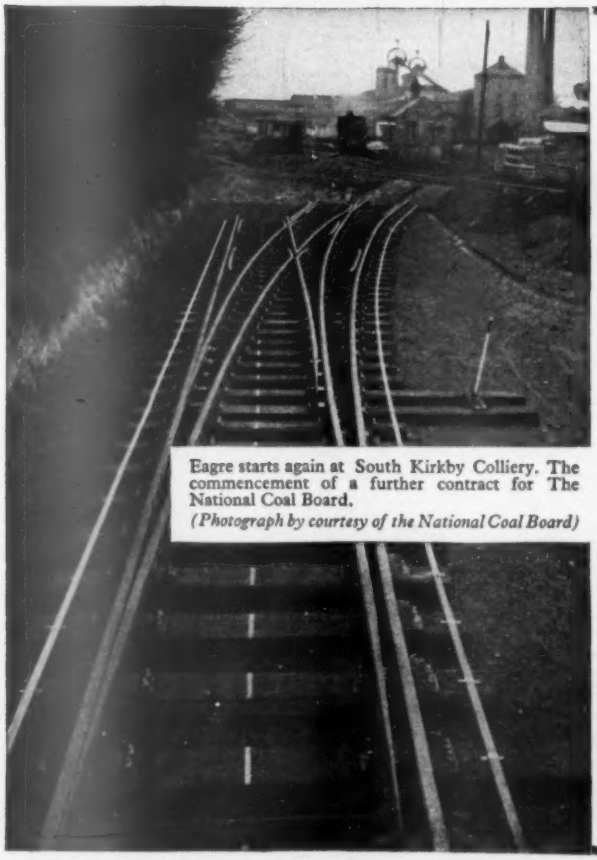

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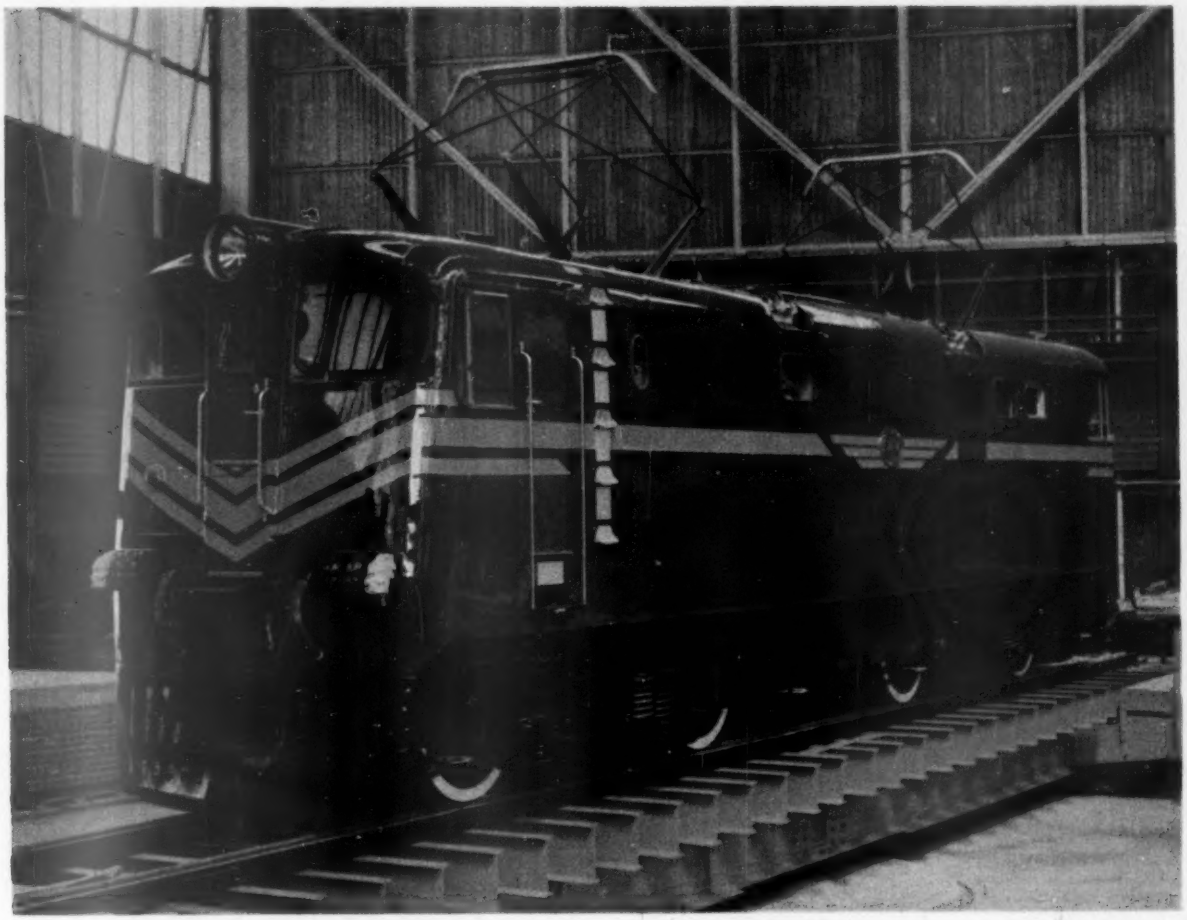

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